166431

Vol. I.

TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, [redacted] 1923

No. [redacted] 185

JOHN E. THROPP'S SONS COMPANY, PETITIONER,

vs.

FRANK A. SEIBERLING.

WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

PETITION FOR CERTIORARI FILED JANUARY 2, 1924.

CERTIORARI AND RETURN FILED MARCH 20, 1924.

(29,324)

(29,324)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1922.

No. 774.

THE JOHN E. THROPP'S SONS COMPANY, PETITIONER,

vs.

FRANK A. SEIBERLING.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

INDEX.

	Page.
Record from U. S. district court for the district of New Jersey	i
Docket entries	i
Amended bill of complaint	1
Order filing bill, etc	6
Order as to taking testimony	7
Disclaimer of Frank A. Seiberling in U. S. Patent Office in re patent No. 941,962	9
Amended answer	12
Offers in evidence	23
Testimony of Arthur S. Browne	24
Frederick Ray	87
Walter S. Koplin	92
Charles R. Drach	99
Cary D. Derry	107
William Heller	115
Louis Stark	125
William G. Green	135
Warren C. Gregg	146

JUDD & DETWEILER (INC.), PRINTERS, WASHINGTON, D. C., APRIL 4, 1923.

	Page.
Testimony of Tod J. Mell	152
John W. Thomas	159
William R. Murphy	162
Guy L. Evans	164
Mark W. Roe	166
Harvey J. Bittaker	173
Harry K. Raymond	187
William W. Duncan	191
Paul J. Salvatore	207
Frank N. Waterman	210
Thomas A. Walch	285
Talcut I. Curtis	293
Will C. State	302
Frank A. Seiberling	386
Arthur R. Mackey	414
Arthur S. Browne (recalled)	430
Alexandre G. H. Spiers	519
Frederick Ray (recalled)	528
Arthur F. Bedell	597
Wayne A. Rawles	606
William H. Price, Jr	614
Roland S. Trogner	620
Plaintiff's Exhibit No. 1—State patent No. 941,962	1
No. 2—Thropp and De Laski patent No. 1,119,326	25
No. 4—Diagram of original flat fabric before shaping	59
No. 5—Diagram of fabric shaped to core	61
No. 7—Diagram of saw-tooth path of hand tool	63
No. 8—Sketches of experimental work, numbers 1 to 15, inclusive	65
No. 10—Diagram of carcass and wheel rim	99
No. 11—Photograph of manual circumferential stretching	101
No. 12—Diagram of State's spiral path	103
No. 13—Stevens patent No. 1,253,105	105
No. 14—Copy of journal entitled "Moniteur Belge"	137
No. 16—Plaintiff's forms of license agreement since January, 1919	143
No. 17—Vulcanizing charts of Mackey and Shaw tires	149
No. 20—Sketch of Ray holding device	153
No. 21—Sketch of Ray bursting apparatus	155
No. 22—Extracts from "American Machinist Gear Book"	157
No. 23—Extracts from "The Theory of Machines"	159
No. 24—Extracts from "Pure Mechanism"	165
No. 26—Series of articles by F. A. Halsey on worm and spiral gearing in the "American Machinist"	167
No. 35—Photographs of State machines	189

Page.

Defendant's Exhibit A—Browne's sketch of gearing..... 193
F—Mathern Belgian patent No. 194,731 and translation 195
G—British patent No. 25,588 to State..... 229
J—Vincent patent No. 794,473..... 245
K—Seiberling and Stevens patent No. 762,561.. 257
L—Moore patent No. 518,112..... 273
M—Jeffery patent No. 607,245..... 285
N—Bayne and Subers patent No. 847,041..... 291
O—Translation of Mathern German patent No. 206,197 305
P—Translation of Hernandez French patent No. 395,812..... 313
Q—Dewey patent No. 438,407..... 319
R—Early Seymour patent No. 80,836..... 323
S—Later Seymour patent No. 376,167..... 327
U—Extracts from State's file-wrapper..... 335
Z—Ray sketch of Mathern Belgian patent, showing rolls 30..... 397

Opinion, Bodine, J..... 399
Final decree..... 400
Assignment of errors..... 400
Petition for appeal..... 401
Order allowing appeal and fixing bond..... 402
Citation and service..... 402
Proceedings in U. S. circuit court of appeals..... 402
Argument and submission..... 402
Opinion, Buffington, C. J..... 403
Dissenting opinion, Davis, J..... 415
Decree 417
Petition for rehearing..... 417
Affidavit of William H. Kavanaugh..... 423
George B. Pegram..... 425
Robert M. Anderson..... 427
Memorandum in opposition to petition for rehearing..... 429
Order denying petition for rehearing..... 432
Clerk's certificates..... 432
Writ of certiorari and return..... 433

IN THE

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF NEW JERSEY.

In Equity.

Letters Patent Nos. 762, 561, and 941, 962.

FRANK A. SEIBERLING

v.

THE JOHN E. THROPP'S SONS COMPANY.

Docket Entries.

April 11, 1914. Bill filed.
" 13, " Subpœna issued.
" 14, " Subpœna returned, served April 13, and filed.
May 4, " Note of Issue filed.
" " " Motion to dismiss bill filed.
" 7, " Withdrawal of Motion filed.
" 13, " Amended Bill of Complaint and Order filed.
" 16, " Answer filed.
July 11, " Stipulation and Order to take depositions filed.
Sept. 17, " Stipulation and Order extending time to take depositions filed.
Oct. 29, " Stipulation and Order extending time to take depositions filed.
Dec. 18, " Stipulation and Order extending time to take depositions filed.
Feb. 2, 1915. Stipulation and Order extending time to take depositions filed.
April 12, " Stipulation and Order extending time to take depositions filed.
June 9, " Stipulation and Order extending time to take depositions filed.
Sept. 10, " Stipulation and Order extending time to take depositions filed.
Nov. 3, " Cause placed on Calendar.
" 27, " Stipulation and Order extending time to take depositions filed.
Feb. 7, 1916. Stipulation and Order extending time to take depositions filed.
April 14, " Stipulation and Order extending time to take depositions filed.
July 11, " Stipulation and Order extending time to take depositions filed.

Sept.	5, 1916.	Cause placed on Calendar.
"	" "	Continued for Term.
"	14, "	Stipulation and Order extending time to take dep sitions filed.
Dec.	13, "	Stipulation and Order extending time to take dep sitions filed.
Feb.	16, 1917.	Stipulation and Order extending time to take dep sitions filed.
April	10, "	Stipulation and Order extending time to take dep sitions filed.
June	13, "	Stipulation and Order extending time to take dep sitions filed.
Sept.	18, "	Stipulation and Order extending time to take dep sitions filed.
Jan.	2, 1918.	Stipulation and Order extending time to take dep sitions filed.
Mar.	15, "	Stipulation and Order extending time to take dep sitions filed.
June	25, "	Stipulation and Order extending time to take dep sitions filed.
Sept.	25, "	Stipulation and Order extending time to take dep sitions filed.
Mar.	10, 1919.	Stipulation and Order for Amendment to Answ filed.
"	28, "	Amended Answer and Stipulation filed.
June	9, "	Depositions on behalf of defendant filed.
"	28, "	Depositions of Harvey J. Butaker and Harry Raymond, on behalf of defendant filed.
July	7, "	Depositions on behalf of defendant filed.
Nov.	6, "	Depositions on behalf of complainant filed.
"	17, "	Complainant's Prima Facie Proofs filed.
"	" "	Complainant's Rebuttal Proofs filed.
Jan.	17, 1921.	Defendant's Testimony filed.
Mar.	31, "	Depositions on behalf of defendant filed.
April	11, "	Stipulation and Order withdrawing files for prin ing &c. filed.
Dec.	13, "	Final Hearing.
"	14, "	Final Hearing. Decision reserved.
Feb.	14, 1922.	Memorandum filed.
"	21, "	Final Decree dismissing Bill with costs to defen ant filed.
Mar.	2, "	Assignment of Errors filed.
"	" "	Petition for Appeal and Order allowing Appe filed.
Mar.	30, "	Bond on Appeal filed.
"	" "	Citation issued.

United States District Court,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING, Plaintiff, vs. THE JOHN E. THROPP'S SONS COMPANY, Defendant.	In Equity #614. Upon Patents Nos. 762,561 and 941,962.

Amended Bill of Complaint.

(Filed May 13, 1914.)

TO THE HONORABLE THE JUDGES OF THE UNITED STATES DISTRICT COURT IN AND FOR THE DISTRICT OF NEW JERSEY:

Plaintiff for his cause of action alleges as follows:

1. That plaintiff, Frank A. Seiberling, is a citizen of the United States, and a resident and inhabitant of the Eastern Division of the Northern District of Ohio, and has a place of business in the city of Akron in said division and district; and upon information and belief that defendant, The John E. Thropp's Sons Company, is an existing corporation organized under the laws of the State of New Jersey, and a resident and inhabitant of the district and state of New Jersey, and has a regular and established place of business in the city of Trenton.

2. Upon information and belief that the jurisdiction of this court depends upon the facts that this suit is one arising under the patent laws of the United States.

3. That plaintiff, together with one William C. Stevens, being, under the then existing patent laws of the United States, the joint inventors of certain improvements in machines for making outer casings for double tube tires, duly made application on November 28th, 1903, to the Commissioner of Patents of the United States for patent for said improvements and that United States Letters Patent No. 762,561 were lawfully granted on June 14th, 1904, to said inventors as joint patentees, they having duly complied with all the requirements of the then existing statutes of the United States and the rules of the Patent Office; whereby the exclusive rights in said improvements were secured to said patentees for seventeen years thereafter; as by said patent or certified copy thereof in court to be produced will more fully appear.

4. That on March 23rd, 1909 said William C. Stevens, by an instrument in writing duly assigned to plaintiff his entire right, title and interest in said patent No. 762,561, together with all claims for damages and profits for past infringement; which instrument was recorded in the Patent Office March 25th, 1909.

5. Upon information and belief that one Will C. State, being, under the then existing patent laws of the United States, the inventor of certain improvements in pneumatic tire shoe manufacturing machines, duly made application on March 26th, 1909, to the Commissioner of Patents of the United States for patent for said improvements, and that United States Letters Patent No. 941,962 were lawfully granted on November 30th, 1909, he having duly complied with all the requirements of the then existing statutes of the United States and the rules of the Patent Office.

6. That said Will C. State, prior to the issue of said patent No. 941,962, namely on March 22nd, 1909, assigned to plaintiff his entire right, title and interest in his said invention and requested the Commissioner of Patents to issue to plaintiff the patent thereon, which instrument was recorded in the United States Patent Office March 31st, 1909; whereupon said patent No. 941,962 was granted on the date aforesaid to plaintiff as patentee; whereby the exclusive rights in said improvements were secured to said patentee for seventeen years thereafter; as by said patent or certified copy thereof in court to be produced will more fully appear.

7. That plaintiff is now, and has been at all times since March 23rd, 1909, the sole and exclusive owner of each of said patents Nos. 762,561 and 941,962, respectively and the inventions covered thereby, and all claims for damages and profits arising out of infringement thereof.

8. That plaintiff or his licensees have expended large sums of money in making the inventions of both of said patents profitable to themselves and useful to the public; that said inventions have been and are of great benefit and advantage to the public; that plaintiff's rights thereunder have been extensively acknowledged and acquiesced in by the public; that licenses have been granted under both of said patents to enable said inventions to be practiced, and large royalties were paid to plaintiff thereunder; that plaintiff and his licensees are entitled to be protected in their enjoyment of said inventions; and that plaintiff upon learning of this defendant's infringement hereinafter referred to did promptly give defendant due notice of said patents and plaintiff's rights thereunder.

9. Upon information and belief that, heretofore and during plaintiff's ownership of said patents, defendant,

unlawfully, without license or consent of plaintiff, and within the District of New Jersey, and elsewhere in the United States, has infringed upon said patent No. 762,561, and also upon said patent No. 941,962, and also upon said two patents jointly by making and using machines for manufacturing shoes or outer casings for pneumatic or double tube tires, containing the inventions of each and of both of said patents in suit, and has thereby realized large profits and advantages which would otherwise have accrued to plaintiff; that defendant is continuing, and threatening to continue, the manufacture and use of said infringing machines; and that by defendant's unlawful acts plaintiff has been and is being caused large and irreparable damage.

10. Upon information and belief that the claims of the said patents upon which defendant has been and is now infringing are as follows: patent No. 762,561, claims 1, 2 and 14; patent No. 941,962, claims 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 22, 23, 24, 25 and 26.

WHEREFORE plaintiff, waiving verification of defendant's answer herein, when filed, hereby prays the court;

(1) That writs of injunction, as well provisional as permanent, be issued and served, enjoining and restraining defendant, The John E. Thropp's Sons Co., its solicitors, clerks, servants, agents, attorneys and workmen, from directly or indirectly in any manner infringing upon said patents Nos. 762,561 and 941,962 or either of them;

(2) That defendant account to plaintiff for the profits made by defendant and the damage sustained by plaintiff; and that, upon rendering a decree herein, the amount of damages assessed shall be trebled in view of the wilful and unjust infringement of defendant;

(3) That costs be awarded to plaintiff;

(4) And that such other and further relief may be accorded to plaintiff as appears to be proper and agreeable to equity.

FRANK A. SEIBERLING,
Plaintiff

ROGERS, KENNEDY & CAMPBELL
Solicitors for Plaintiff
JAMES Q. RICE
Of Counsel
ROBERT F. ROGERS
Of Counsel.

VERIFICATION.

UNITED STATES OF AMERICA
State of New York } ss.
County of New York

FRANK A. SEIBERLING, being duly sworn, deposes and says that he is the plaintiff in this suit, and that he has read and signed the foregoing amended bill of complaint, and that the same is true to his own knowledge, excepting as to the matters therein stated to be alleged upon information and belief, and as to those matters he believes it to be true, and that he believes that he with the said William C. Stevens, referred to in said bill of complaint, were the true, original, first and joint inventors of the improvements disclosed and covered in said patent in suit No. 762,561, and that the said Will C. State, referred to in said bill of complaint, was the true, original, first and sole inventor of the improvements disclosed and covered in said patent in suit No. 941,962.

FRANK A. SEIBERLING

Subscribed and sworn to before me this 8th day of May, 1914.

WILLIAM JAMES DOLAN
Notary Public
Rockland County
Certificate filed N. Y. County No. 95
New York Register No. 6168.
Commission expires March 30, 1916.

UNITED STATES DISTRICT COURT

DISTRICT OF NEW JERSEY,

FRANK A. SEIBERLING, Plaintiff. vs. JOHN E. THROPP & SONS COMPANY, Defendant.	In Equity Upon Patents, Nos. 762,561 and 941,962

Order.

Upon motion and annexed consent of counsel for both parties hereto it is hereby

ORDERED AS FOLLOWS:

1. That the amended bill of complaint herewith presented by plaintiff for filing shall be and the same hereby is ordered to be filed and entered herein in the place of the original bill of complaint.

2. That defendant's motion to dismiss the bill of complaint be and the same hereby is withdrawn, it appearing to the satisfaction of the parties and the Court that said bill has been amended by plaintiff so far as the said motion properly demands.

3. That the summons and other process heretofore issued or served herein may be and hereby are amended by changing the name of the defendant to read "The John E. Thropp's Sons Company."

4. That defendant shall file its answer or other defense hereto on or before May 16th, 1914 on failure of which plaintiff may take decree *pro confesso*.

Dated, Trenton, N. J. May 13th, 1914.

JOHN RELLSTAB.
U. S. District Judge.

Consent.

On behalf of the respective parties hereto counsel hereby consent to the entry of the above form of order.

Dated, New York, May 8th, 1914.

ROBERT F. ROGERS
Counsel for Plaintiff.
E. CLARKSON SEWARD.
Counsel for Defendant.

At a stated term of the District Court of the United States in and for the District of New Jersey, held in the courtrooms of said Court in the City of Newark on the 3rd day of February, 1919.

Present:

THOMAS G. HAIGHT
U. S. Judge.

FRANK A. SEIBERLING,
Plaintiff,
v.
THE JOHN E. THROPP'S SONS COMPANY,
Defendant.
In Equity No. 614.

Order.

This matter coming on for consideration upon the motion of plaintiff and the annexed consent of both parties by their solicitors, now, then, good and sufficient cause appearing therefor, it is hereby

ORDERED, as follows:

(1) That the testimony in this cause of any and all witnesses shall be taken out of court, before Edward O'Byrne, Esq., or other standing Examiner of this Court, or in appropriate instances outside of this district by any

duly qualified Examiners or notaries public, agreed upon by the parties, who may act as special examiners without further appointment.

(2) That plaintiff may have until April 1, 1919, for taking its *prima facie* proofs, defendant until July 1, 1919 for its proofs in defense, and plaintiff until August 15, 1919 for its rebuttal.

(3) That either party taking testimony hereunder shall give the solicitors of the other party five days' notice thereof, stating forth the names of the witnesses, the examiner, and the place, date and hour of the testimony.

THOMAS G. HAIGHT
U. S. Judge.

On this third day of February, 1919, we hereby consent to the making and entry of the above form of order.

ROGERS, KENNEDY & CAMPBELL
Solicitors for Plaintiff.

E. CLARKSON SEWARD
Solicitor for Defendant.

IN THE UNITED STATES PATENT OFFICE.

Disclaimer

PERTAINING TO PATENT No. 941,962.

(Filed in the Patent Office, Feb. 15, 1919).

TO THE HONORABLE COMMISSIONER OF PATENTS,
Washington, D. C.

I, FRANK A. SEIBERLING, a citizen of the United States, residing at Akron, in the County of Summit, and State of Ohio, hereby represent, in the matter of a certain improvement in Pneumatic Tire Shoe Manufacturing Machines for which Letters Patent of the United States No. 941,962 were granted to me as assignee of Will C. State, also of said Akron, Ohio, on the 30th day of November, 1909, that I am the owner of the entire interest in said patent by reason of the aforesaid grant thereof to me, and that I have reason to believe that through inadvertence, accident or mistake, and without fraudulent or deceptive intention, the specification and claim of said Letters Patent are in part too broad, including that of which said State was not the first inventor.

Now, therefore, I hereby enter disclaimer, as follows:

FIRST: In respect to each of claims 4, 5, 6 and 7, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the ring-core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force, and the recited spinning-roll support is mechanically mounted to ensure its radial movement with a gradual advance in proper relation to the fast rotating ring-core, whereby the spinning-roll, by such gradual advance over the ring-core and while pressed

toward it, acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

SECOND: In respect to each of claims 12 and 13 of said patent, I hereby disclaim any combination of the recited elements, *except for* the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core and thereafter shaping and applying to the ring-core the fabric beyond the tread portion, *and unless* the recited elements are so constructed and co-ordinated that before the change from slow speed to fast speed the fabric strip as drawn from the recited stock roll onto the ring-core is stretched circumferentially under uniform tension while applying it to the tread portion, and, after the change to fast speed, the unapplied fabric beyond the tread portion is thrown out from the side of the ring core by the consequent centrifugal force, while the recited spinning-roll, in its radial movement, acts gradually upon the centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core beyond the tread portion while bringing it into adhesive contact therewith.

THIRD: In respect to each of claims 22, 23, 24, 25 and 26, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll, in its radial movement and while pressed toward the ring-core, functions by a gradual

action upon such centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

FOURTH: I hereby further disclaim that part of the claim of invention in said patent contained in claims 8, 9, 10, 11, 14, 15, 16 and 17, respectively.

FIFTH: In respect to the specification of said patent, I hereby disclaim at page 1, lines 79-80, the words "and an important feature of my invention", and at page 1, lines 92-93, the words "as another feature of my invention".

SIGNED at New York in the County of New York and State of New York, this 13th day of February, 1919.

FRANK A. SEIBERLING.

Witnesses:

R. F. ROGERS.

ARTHUR S. BROWNE.

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Complainant
vs.
THE JOHN E. THROPP'S SONS COMPANY,
Defendant

In Equity No. 614.

Amended Answer.

(Filed March 28, 1919.)

THE AMENDED ANSWER OF THE ABOVE NAMED DEFENDANT TO THE AMENDED BILL OF COMPLAINT OF THE ABOVE NAMED COMPLAINANT.

I. This defendant admits the allegations contained in Paragraphs 1 and 2 of the said Bill of Complaint.

II. This defendant admits that United States Letters Patent No. 762561 were granted on June 14, 1904, to Frank A. Seiberling and William C. Stevens, but denies that said patent was lawfully granted. As to whether or not the complainant and said William C. Stevens duly made application for said Letters Patent and complied with all the requirements of the then existing statutes of the United States and the Rules of the Patent Office, as alleged in said Bill of Complaint, this defendant is without knowledge and leaves the complainant to his proof thereof.

III. This defendant denies that the complainant and said William C. Stevens were, on November 28, 1903, or

at any time, under the then existing patent laws of the United States, the joint inventors of certain improvements in machines for making outer casings for double tube tires as alleged in said bill of complaint; but says, upon information and belief, that the said alleged improvements of the said patent No. 762561, and all substantial and material parts thereof, and particularly of claims numbers 1, 2 and 14 thereof, had been known and used by others in this country before the said complainant and William C. Stevens made the said alleged invention or discovery thereof, and had been in public use and on sale in this country prior to the said alleged invention or discovery and for more than two years before the alleged application for said letters patent No. 762561; and further, that the said alleged invention had been described and illustrated in printed publications and patents prior to the date of the said alleged invention or discovery and more than two years prior to the alleged application for patent; and specifies instances of such prior publication as follows:

LETTERS PATENT OF THE UNITED STATES:

No. 125598	T. J. Mayall	April	9, 1872
125599	T. J. Mayall	Apr.	9, 1872
6162	J. R. Moffitt (Reissue)	Dec.	8, 1874
186256	G. E. Jones	Jan.	16, 1877
215321	H. Gavin	May	13, 1879
284929	S. Wheeler	Sept.	11, 1883
286115	J. Chaumont	Oct.	2, 1883
410521	G. L. Jaeger	Sept.	3, 1889
420354	S. Odenheimer	Jan.	28, 1890
428190	A. Watts & R. Henry	May	20, 1890
438407	M. W. Dewey	Oct.	14, 1890
518112	G. C. Moore	Apr.	10, 1894
557729	A. T. Tregurtha	Apr.	7, 1896
557791	J. Findlay	Apr.	7, 1896
558735	J. P. Luckett	Apr.	21, 1896
607245	T. B. Jeffery	July	12, 1898

642976.....T. H. Grigg.....Feb. 6, 1900
648930.....H. J. Doughty.....May 8, 1900
658901.....W. H. Taneyhill.....Oct. 2, 1900
692012.....G. E. Heyl-Dia.....Jan. 28, 1902
725155.....F. A. Seiberling.....April 14, 1903
745300.....U. P. Smith.....Nov. 24, 1903

LETTERS PATENT OF THE KINGDOM OF GREAT BRITAIN.

No. 23135 .....The Thomas & William Caldwell Syndicate Ltd. *et al*.....Nov. 3, 1898
27486 .....W. & L. Swain.....Dec. 30, 1898
5430 ..... Swain..... 1898
3851 .....The Swain Patents Syndicate Ltd. and W. Swain.....Feb. 28, 1900

LETTERS PATENT OF THE REPUBLIC OF FRANCE.

289195.....The Radax Pneumatic Tire Co., Ltd. 1899

LETTERS PATENT OF AUSTRIA.

1136 .....The Radax Pneumatic Tyre Co., Ltd. .....Dec. 15, 1899

and other patents and publications of which the said defendant has not now the particulars, but which it craves leave to insert in this Answer by way of Amendment as soon as said particulars are received. This defendant specifies instances of such prior knowledge and use as follows; by the patentees of the above mentioned patents at the places of residence specified in said patents respectively. Wherefore said claims of said patent No. 762561 are invalid.

IV. This defendant is without knowledge with regard to the matters alleged in Paragraph 4 of the said Bill of Complaint and leaves the complainant to his proof thereof.

V. This defendant denies that complainant and said William C. Stevens were the true joint inventors of the

improvements of said patent, and particularly of claims 1, 2, and 14 thereof, but alleges, upon information and belief, that said improvements were the sole invention of the said William C. Stevens. Wherefore said claims are invalid.

VI. This defendant says that claims 1, 2 and 14, of said patent No. 762561 are not distinct, wherefore said claims are invalid.

VII. This defendant says, upon information and belief, that the apparatus shown and described in said patent No. 762561, and particularly set forth in claims 1, 2 and 14, is without utility and inoperative; wherefore said claims are invalid.

VIII. This defendant says, upon information and belief, that for the purpose of deceiving the public, the description filed in the Patent Office and contained in the said patent No. 762561, was made to cover less than the whole truth relevant to the apparatus set forth therein, and particularly claimed in claims 1, 2 and 14; wherefore said claims are invalid.

IX. This defendant says that the description of the alleged invention in the said patent No. 762561, is not in such full, clear, concise, or exact terms as to enable any person skilled in the art to which it appertains or with which it is most nearly connected, to make or use the same, and particularly the apparatus set forth in claims 1, 2 and 14; wherefore said claims are invalid.

X. This defendant says that claims 1, 2 and 14 of said patent No. 762561 all cover aggregations and not combinations, and hence are invalid.

XI. This defendant says that claims 1, 2 and 14 of said patent No. 762561 are void for want of patentable invention.

XII. This defendant admits that United States Letters Patent No. 941962 were granted to Frank A. Seiberling, November 30, 1909, as assignee of Will C. State, but denies that said patent was lawfully granted. As to whether or not said Will C. State duly made application for said Letters Patent and complied with all the requirements of the then existing Statutes of the United States and the rules of the Patent Office, as alleged in said Bill of Complaint, this defendant is without knowledge and leaves the complainant to his proof thereof.

XIII. This defendant denies that said Will C. State was on March 26, 1909, or at any time, under the then existing patent laws of the United States, the inventor of certain improvements in pneumatic tire shoe manufacturing machines as alleged in said bill of complaint; but says, upon information and belief, that the said alleged improvements of the said patent No. 941962, and all substantial and material parts thereof, and particularly of claims numbers 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 22, 23, 24, 25 and 26 thereof, had been known and used by others in this country before the said Will C. State made said alleged invention or discovery thereof, and had been in public use and on sale in this country prior to the said alleged invention or discovery and for more than two years before the alleged application for said letters patent No. 941962, and further, that the said alleged invention had been described and illustrated in printed publications and patents prior to the date of said alleged invention or discovery and more than two years prior to the alleged application for patent; and specifies as instances of such prior publications the patents set forth in Paragraph III hereof, and in addition thereto the following:

LETTERS PATENT OF THE UNITED STATES.

No. 753813	U. P. Smith	March	1, 1904
762561	F. A. Seiberling & W. C. Stevens	June	14, 1904
782017	A. N. Fairman	Feb.	7, 1905
794473	A. E. Vincent	July	11, 1905
800598	F. A. Seiberling & U. P. Smith	Sept.	26, 1905
832207	J. R. Pierce	Oct.	2, 1906
847041	E. D. C. Bayne & L. A. Subers	Mar.	12, 1907
852855	T. & R. Sloper	May	7, 1907
906588	A. E. Vincent	Dec.	15, 1908
16564	Cannon	Feb.	3, 1857
67262	Buzzee	July	30, 1867
80836	Seymour	August	11, 1868
152325	Boeklen *et al.*	June	23, 1874
221456	Hall	Nov.	11, 1879
231327	Joslin	August	17, 1880
240145	Kearns *et al.*	April	12, 1881
260298	Kelsey	June	27, 1882
376167	Seymour	Jan.	10, 1888
669836	Johnstone	March	12, 1901
669837	Johnstone	March	12, 1901
813604	Watzke	Feb.	27, 1906

LETTERS PATENT OF THE KINGDOM OF GREAT BRITAIN.

No. 4834	V. P. Pfister *et al.*	Mar.	14, 1900
10059	L. Johnstone	May	4, 1903
20440	G. A. E. Kohler	Sept.	22, 1904
23590	T. & R. Sloper	Nov.	16, 1905
18587	The New Eccles Rubber Works Ltd. *et al.*	Aug.	20, 1906
24965	Black		1897
17432	Walton		1906
1207	Hubbard *et al.*		1907

LETTERS PATENT OF THE REPUBLIC OF FRANCE.

No. 349812	A. E. Vincent	April	12, 1904
5864	A. E. Vincent	Jan.	11, 1906
364819	P. M. C. Nivet	March	31, 1906
364820	P. M. C. Nivet	March	31, 1906
370188	T. Sloper & R. Sloper	Aug.	20, 1906
371493	J. B. A. Nivet	Nov.	14, 1906
384143	E. D. C. Bayne & L. A. Subers	Nov.	18, 1907
395812	M. Hernandez	Jan.	7, 1908

LETTERS PATENT OF THE EMPIRE OF GERMANY.

No. 199424	T. Sloper & R. Sloper	Aug.	15, 1906
200627	E. D. C. Bayne & L. A. Subers	March	13, 1907
206197	A. Mathern	Dec.	20, 1906

LETTERS PATENT OF AUSTRIA.

No. 20497 .....Phil. Penin. Gummi-Fabrik A.G. April 1, 1907

LETTERS PATENT OF BELGIUM.

No. 194731.....Mathern .....Sept. 20, 1906

and other patents and publications of which the said defendant has not now the particulars, but which it craves leave to insert in this Answer by way of Amendment as soon as said particulars are received. This defendant specifies instances of such prior knowledge and use as follows: By the B. F. Goodrich Company at Akron, Ohio. By the Bayne-Subers Tire and Rubber Co., at Cleveland, Ohio. By the Goodyear Tire & Rubber Co., at Akron, Ohio. By the Lee Tire & Rubber Co., at Conshohocken, Penn., and by the patentees of the patents above referred to at the places of residence recited in the said patents respectively. Wherefore said claims of said patent No. 941,962 are invalid.

XIV. This defendant is without knowledge as to the matters contained in Paragraph 6 of the said Bill of Complaint, except the allegation as to the grant of the Patent No. 941,962, and accordingly, leaves the complainant to his proof thereof.

XV. This defendant says, upon information and belief, that said Will C. State was not the sole inventor of the apparatus set forth in said patent No. 941,962, and particularly in the above noted claims thereof; but that he was joint inventor thereof together with certain other parties who developed the said apparatus with him and contributed material parts thereto, the names of said other parties being William Sackman, Frank R. Chamberlain, William J. Kreuder, Otis O. Smith and Chas. Wattelworth, all at said time being of Akron, Ohio.

XVI. This defendant says that the above noted claims of said patent No. 941,962 are not distinct; wherefore said claims are invalid.

XVII. This defendant says, upon information and belief, that the apparatus shown and described in said patent 941,962, and particularly set forth in the above noted claims thereof is without utility and inoperative; wherefore said claims are invalid.

XVIII. This defendant says, upon information and belief, that for the purpose of deceiving the public, the description filed in the Patent Office and contained in said patent 941,962, was made to cover less than the whole truth relevant to the apparatus set forth therein, and particularly claimed in the above noted claims; and that the complainant herein and the said Will C. State, during the pendency of the said application in the Patent Office, made misrepresentations to the Patent Office officials containing matters relevant to the alleged invention and particularly the apparatus recited in the above named claims; which misrepresentations were in the form of affidavits filed with the said application, and which affidavits were made to contain inaccurate statements by said complainant and Will C. State, and were filed for the purpose of misleading with regard to the facts as to the invention, and actually did so mislead and cause the said patent 941,962 to be granted in its present form. Wherefore said claims are invalid.

XIX. This defendant says that the description of the alleged invention in the said patent 941,962 is not in such full, clear, concise, or exact terms as to enable any person skilled in the art to which it appertains or with which it is most nearly connected, to make or use the same, and particularly the apparatus set forth in the above noted claims; wherefore said claims are invalid.

XX. This defendant says, upon information and belief, that the above noted claims of patent 941,962 are broader than the invention set forth in the original application for said patent; wherefore said claims are invalid.

XXI. This defendant says, upon information and belief, that the above noted claims of said patent 941,962 were so limited by the applicant during the prosecution of the application for said patent, that complainant is now estopped to claim for them a construction sufficiently broad to cover any apparatus manufactured or used by this defendant.

XXII. This defendant says, upon information and belief, that the apparatus shown in the said patent 941,962, and particularly set forth in the above named claims, has never been manufactured, and that the complainant has never marked any machines manufactured or disposed of by him, with the word "Patented" or any abbreviation thereof, or with the date of the said patent or number thereof, or any of these things, as required by Section 4900, Revised Statutes of the United States.

XXIII. This defendant says that the above noted claims of said patent 941,962 are void for want of patentable invention.

XXIV. This defendant says that the previously noted claims of said patent 941,962 cover aggregations and not combinations, and hence are invalid.

XXV. This defendant says, upon information and belief, that the plaintiff has disclaimed, by formal document executed and filed in the Patent Office, subsequent to the issuance of said patent No. 941,962, the whole substance of the alleged invention set forth in said patent.

XXVI. This defendant says that said disclaimer named in Paragraph XXV hereof was unlawfully made and filed, and that the changes in the said patent attempted to be made by said disclaimer should, under the law, if made at all, have been made by way of reissue; and that plaintiff unreasonably delayed the filing of said disclaimer.

XXVII. This defendant denies, upon information and belief, the allegations contained in Paragraph 7 of said Bill of Complaint; and avers that the Goodyear Tire and Rubber Company of Akron, Ohio, is the owner of part or all of the legal and equitable title to each of said patents Nos. 762,561 and 941,962, and is therefore a necessary party to this suit.

XXVIII. This defendant denies, upon information and belief, the allegations contained in Paragraph 8 of the Bill of Complaint and says that the inventions of neither of said patents have been profitable or useful or of any benefit or advantage whatsoever to the public; and that the complainant's rights under neither of said patents have been acknowledged or acquiesced in by the public; but that numerous concerns have been for long periods using, in defiance of complainant's alleged rights, tire making machines corresponding to the subject-matter included in the above noted claims of both said patents; and cites as specific instances of such use in defiance of said alleged rights, the Miller Rubber Company of Akron, Ohio; The Firestone Tire and Rubber Company of Akron, Ohio, the B. F. Goodrich Company of Akron, Ohio, and the Pennsylvania Rubber Company of Jeanette, Pennsylvania.

XXIX. This defendant denies that the complainant has given it notice of either of said patents, or of his alleged rights under either of them, but says that defend-

ant has been, for a period of between two and three years, commercially exploiting tire making machines of one type only; and, upon information and belief, that this commercial exploitation has been well known to the complainant herein, but that said complainant, for the purpose of deceiving this defendant and leading it to believe that the complainant did not claim that the machines exploited by this defendant were an infringement of any of complainant's rights, has deliberately failed to notify this defendant of the complainant's rights alleged in the Bill of Complaint or any thereof, and that defendant has been misled thereby; wherefore this complainant is now estopped by this conduct and his laches from maintaining this suit against this defendant.

XXX. This defendant denies that it has at any time within the District of New Jersey or elsewhere in the United States, made or used machines containing the inventions of either or both of said alleged patents or of any of the above noted claims thereof; or that it has realized any profits or advantages which would otherwise have accrued to complainant, or that it is continuing or threatening to continue the manufacture or use any of such machines; or that by its acts, the complainant has been or is being caused any damage whatsoever.

WHEREFORE this defendant denies that the complainant is entitled to an injunction, either provisional or permanent, against it, or to an accounting of profits or damages, or to costs, or to any relief whatsoever; and prays that the Bill be dismissed with costs to this defendant.

THE JOHN E. THROPPS' SONS CO.,
E. CLARKSON SEWARD
Defendant's Solicitor

E. CLARKSON SEWARD
Of Counsel.

IN THE

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING, Plaintiff, vs. THE JOHN E. THROPP'S SONS COMPANY, Defendant.	In Equity No. 614.

Plaintiff's *Prima Facie* Proofs.

Transcript of proceedings on final hearing, before EDWARD O'BYRNE, Esq., Examiner, at the office of Rogers, Kennedy & Campbell, 15 Broad Street, New York City, beginning March 24th, 1919.

APPEARANCES:

For Plaintiff, ROBERT FLETCHER ROGERS, Esq.
For Defendant, E. CLARKSON SEWARD, Esq.

Mr. Rogers introduces in evidence a certified copy of U. S. Letters Patent No. 941,962, issued upon an application of Will C. State on November 30, 1909, to Frank A. Seiberling, plaintiff herein, together with a copy of the grant to plaintiff, and a copy of the disclaimer filed by plaintiff on February 14th, 1919; the same being marked "Plaintiff's Exhibit No. 1, Patent in Suit".

Mr. Rogers also states that with the consent of counsel

he introduces in evidence a certain tire-making machine, not here present, but understood to be in the Court House of the U. S. Circuit Court of Appeals for the Sixth Circuit at Cincinnati, Ohio, said machine being an exhibit in the Firestone case; the same being marked "Plaintiff's Exhibit No. 2, State Machine".

Mr. Rogers also states that with the consent of counsel he introduces in evidence a copy of U. S. Letters Patent No. 1,119,326, issued upon an application of John E. Thropp, Peter D. Thropp and Albert De Laski, on December 1, 1914; the same being marked "Plaintiff's Exhibit No. 3, Patent on Defendant's Machine".

Mr. Rogers also refers to the exhibition on March 18, 1919 at Trenton, New Jersey, of one of defendant's carcass-making machines; in this connection Mr. Seward states that this machine in construction and mode of operation is substantially the same as the machines manufactured and leased by defendant prior to the filing of the Bill of Complaint herein, and that it is his intention later on to introduce it in evidence as "Defendant's Machine".

Whereupon, ARTHUR S. BROWNE, being duly sworn, does depose and say, in answer to interrogatories propounded to him by Mr. Rogers, as follows:

Q. 1. Please state your name, residence and occupation.

A. Arthur S. Browne, Washington, D. C., patent solicitor and expert.

Q. 2. Will you kindly state your experience and training that qualify you, as you believe, to give testimony as to mechanical matters in this cause.

A. I was graduated from Dartmouth College in 1881 and the following year entered my present profession in which I have since been actively and continuously engaged. I have prosecuted many hundreds of applications for patents and have testified as an expert witness

in more than five hundred patent suits in the United States and other courts.

I have been familiar with the subject of pneumatic tires, since the same were first introduced on bicycles some thirty years ago and subsequently on their adoption and use on automobiles. I have testified in several patent suits in which pneumatic tires both for bicycles and for automobiles have been involved, and in which it has been necessary for me to familiarize myself with the history of the art and to become familiar with the conditions surrounding their use. I have also become familiar with the action of such tires on automobiles both in the use of my own car and from the observation of cars other than my own.

I have made a special study of the manufacture of tires by the machine of the patent in suit. On several occasions I have visited the factory of the Goodyear Tire & Rubber Company at Akron, Ohio, for the special purpose of familiarizing myself with the construction and mode of operation of machines made in accordance with the patent in suit.

I have also examined the machine of the defendant herein which was exhibited to me and others in Trenton, N. J. on March 18, 1919.

Q. 3. I take it from your last answer that you have read the patent in suit No. 941,962. Will you state whether or not you think you understand the same?

A. I have read and understand the State patent in suit.

Q. 4. And is this last answer of yours intended to cover also the disclaimer filed on the 14th day of February, 1919?

A. It does.

Q. 5. I understand you to say that you have seen defendant's machine in operation. Did that machine bear

Minnesota ... St. Paul, Minn.

any patent plate or otherwise indicate that it was built under existing patents?

A. The defendant's machine which I examined bore a plate having two patent dates, namely, December 1, 1914 and April 27, 1915. The patent date of December 1, 1914 is that of U. S. Letters Patent 1,119,326 granted to the De Laski & Thropp Circular Woven Tire Company of Trenton, N. J., assignee of John E. Thropp, Peter D. Thropp and Albert De Laski. The machine which I saw also had a plate on it stating that John E. Thropp's Sons Co. is a licensee of the De Laski and Thropp Circular Woven Tire Company.

Q. 6. Will you state whether or not the patent you thus specifically refer to presents a machine at all corresponding to defendant's machine as you saw it.

A. This Thropp & De Laski patent substantially illustrates the defendant's machine which I examined.

This patent in its principal figures illustrates an electric motor for driving each of the two fabric forming rolls. In a modification illustrated in Figs. 14 and 15 it illustrates fabric forming rolls which are not driven by independent electric motors but which are rotated solely by frictional engagement with the fabric applied to the rotating core. The defendant's machine which I examined is in this respect like the modification of Figs. 14 and 15 of the patent and it does not have electric motors for driving the fabric forming rolls.

Also, this patent illustrates in Fig. 2, two cones 25 and 26 connected by an adjustable belt by means of which the speed of the machine as a whole is varied. This particular speed changing drive was not on the defendant's machine which I examined.

With these two exceptions, the defendant's machine which I examined is substantially that disclosed in the Thropp & De Laski patent 1,119,326. There are some

mechanical differences which are unimportant so far as the organization and mode of operation are concerned.

Q. 7. Have you ever seen a carcass-making machine substantially like that presented in the State patent in suit?

A. Yes, I have seen a number of such machines at the plant of the Goodyear Tire & Rubber Company, at Akron, Ohio, and I also saw one of these machines at the U. S. Court House in Cincinnati, Ohio, which was operated on the occasion of an argument in a suit against the Firestone Company before the Circuit Court of Appeals of the Sixth Circuit.

Q. 8. Will you kindly explain to the court the construction presented in the State patent in suit and more particularly with reference to the means for shaping or forming the fabric to the sides of the core, comprising generally the rotatable core, the slow speed mechanism, the fast speed mechanism, the speed changing devices, and the forming- or so-called spinning-rolls, together with their operating means. In this connection you may refer also, if you like, to the Goodyear machines which you have inspected in order to illustrate the construction and mode of operation.

A. At the outset the State patent in suit, No. 941,962, of November 30, 1909, says:

> "My invention relates specifically to the manufacture from flat sheets of rubber-coated canvas of the open-bellied casings or more briefly the open casings or tire-shoes which are used in connection with an inflatable inner rubber tube to constitute the double-tube pneumatic tires now used on automobiles and the like." (P. 1, lines 8 to 15.)

The casing or tire-shoe is composed of several superposed layers of duck or canvas impregnated or coated

with rubber compound, this portion of the tire being commonly referred to as the "carcass". This carcass has applied to it beads at the sides, covering strips, and a tread, and the tire is subjected to a vulcanizing process. The State patent in suit is for a machine, the purpose of which is to manufacture the carcass composed of the several layers of canvas or duck. It is upon this carcass that the strength and durability of the tire depends.

The canvas used is in the form of flat strips of material which it is necessary to bring into the shape required for the tire. The State patent in suit specifically illustrates a duplex machine by means of which two like operations can be carried out at the same time. It is important to consider only one-half of the machine as the other half is a duplicate. The patent illustrates in Fig. 2 a detachable ring-core 115, and sections of different forms of this ring-core are illustrated at 136 in Fig. 9 and in Figs. 12, 12^a, 12^b and 12^c. The shape of this core is that of the interior of the finished tire. The object of the machine of the State patent is to form and shape the flat strips of canvas or duck so that the first layer of canvas shall exactly and smoothly fit the contour of the core and so that each successive layer of canvas may be smoothly shaped and formed to fit the layer of canvas previously applied.

The core at its periphery is of a greater diameter and circumference than at any other portion, while at its base it is of smaller radius and circumference. Hence, it is obvious that a strip of canvas long enough to extend around the periphery of the core would be much longer at its edges than the circumference of the core at the base. To take a flat strip of canvas and wind it around the core and lay it down on the sides of the core would necessarily involve the gathering and puckering of portions of the fabric, except that portion which surrounded the core at its periphery. The problem, therefore, is so to shape and

form the flat sheet of fabric that it will accurately and smoothly conform to the core.

The State specifications says:

> "My machine comprises a power-driven ring-core in connection with a pair of stock-rollers which have wound thereon strips of canvas skim-coated with rubber and cut on the bias." (P. 1, lines 28 to 32.)

I produce a diagram illustrating the arrangement of threads in a strip of canvas so cut on the bias and I have designated this diagram "Original Flat Fabric Before Shaping".

As shown in this diagram, the crossing threads of the fabric (which are known as the "weft" and "warp" threads in the textile art) cross each other at right angles; but by reason of the way in which the canvas is cut, each thread whether warp or weft in the flat fabric extends at an angle of 45° to the length of the fabric strip. A strip of fabric so cut on the bias can be stretched either longitudinally or laterally to a substantial extent without weakening the threads. Such a stretching of the fabric will elongate the square reticulations of the fabric and will make them diamond or lozenge shaped. And by such stretching longitudinally and laterally the flat fabric may be made to conform to the contour of the core.

As illustrated in the diagram "Original Flat Fabric Before Shaping", the middle of the fabric can be stretched longitudinally so as to be shaped to the periphery or middle zone of the core. Such stretching will be of the maximum extent at the central line of the middle zone or tread portion of the core and on each side of this middle line the extent of stretch is less and less until the circumferential lines of the core through their decreasing diameters are of the same length as the original fabric. The lines where no stretch of the fabric occurs are indi-

cated at the places designated "median line" in the diagram. This leaves the outer portions or "skirts" of the fabric beyond the median lines which are not stretched at all and which are far from conforming to the inner portions of the sides of the core. These skirts of the fabric can then be stretched laterally or in the direction of the radius of the core, thus elongating the squares of the fabric in a direction at right angles to the lengthwise elongation. In this way the skirts of the fabric are radially stretched and are circumferentially contracted with the result that the skirts of the fabric as well as the middle portion are made to fit snugly and without wrinkles over the core.

This effect is illustrated in a second diagram which I now produce and which is marked "Fabric Shaped to Core". This shows a portion of a sheet of fabric applied to a core, and also illustrates on a larger scale in small figures at the right the effect produced upon the crossings of the threads of the fabric. As indicated in this diagram, the threads at the tread zone are elongated circumferentially so that the original square reticulations are converted into diamonds or lozenges, the long dimension of which is circumferential. At the median zone the fabric is not stretched either longitudinally or radially and accordingly the threads cross each other at the original right angles, as indicated at the small figure marked "Median zone". Between the central tread line and the median zone the reticulations of the fabric gradually change in shape from the pronounced circumferentially elongated diamonds at the tread zone to the squares at the median line.

In this diagram, I have indicated the edge of the fabric by the word "bead", since it is near the edge that the bead of the tire (by means of which it is anchored to the rim of the wheel) is applied. At this bead edge the reticulations of the fabric are elongated laterally with

respect to the fabric or radially with respect to the core to the maximum extent, as indicated in the small figure designated "Bead Zone". As here shown, the long dimension of each diamond or lozenge formed of the crossing threads is elongated radially and is foreshortened circumferentially. Between the median line and the bead edge of the fabric the reticulations of the fabric gradually pass from the square shape at the median line to the radially elongated diamonds at the bead line, the successive reticulations being elongated radially and contracted laterally so as to fit the particular portion of the core which they overlie.

The State specification says:

> "Heretofore such open-bellied or open tire-shoes in so far as they have been made direct from sheeted fabric have been made by hand." (P. 1, lines 15 to 18.)

The flat sheeted fabric can be stretched by hand circumferentially to conform to the tread portion of the core and laterally below the median line to conform to the sides of the core, subject to lack of certainty and uniformity inevitable in such hand manipulation, which is dependent upon the skill of the workman.

The State patent discloses a machine so organized or constructed that this work of shaping the flat fabric to the core is done with uniformity, accuracy and rapidity. In this connection the State patent says:

> "I may say in conclusion that whereas an operator can make seven or eight tires a day by hand, he can make from forty to sixty a day by my machine and make them better than they can be made by hand." (P. 7, lines 46 to 50.)

The characteristics of the machine of the State patent to which the question refers are chiefly those which are

utilized in shaping the skirts of the fabric to the sides of the core below what I have marked as the medium line or zone in the diagrams which I have produced. However, before the skirts of the fabric can be shaped to the sides of the core the fabric must be first properly applied to the peripheral or tread portion of the core.

Fig. 1 of the patent illustrates four rolls of fabric, two of these rolls being employed in connection with each of the ring-cores. The purpose of having two rolls of fabric is in order that superposed layers of canvas on the ring-core will have their sets of threads cross in alternation. The fabric from each supply or stock roll on its way to the ring-core passes around rollers, as indicated in Fig. 2, one of which is a tension roller to which tension is applied by the mechanism illustrated in Fig. 7, and the leading end of the fabric is cemented to the core as illustrated in Fig. 2. The core is then slowly revolved, thereby drawing off the fabric under tension from its supply roll and thereby giving the desired uniform longitudinal stretch to the middle portion of the fabric which is engaged by the outer periphery or tread zone of the core. The specification says that

> "I apply the canvas to the power-driven ring-core while thus moving quite slowly, say at six revolutions a minute." (P. 2, lines 1 to 4.)

The core is rotated slowly by power until a single layer of fabric has been passed completely around it. Then the core is stopped and the canvas is severed by the workman who fastens the last end of the canvas so as to slightly overlie the leading edge, the rubber compound with which the canvas is provided ensuring the adhesion of these overlying ends.

At this stage the fabric is stretched at its middle so as to conform to the tread zone of the core and its mar-

gins or skirt portions are unattached and are no longer flat, but are in a loose, baggy condition.

The machine of the State patent is provided with speed changing mechanism, illustrated in Figs. 3 and 4 and described in the specification, beginning at line 115, page 3. After a layer of fabric has been applied to the core the speed changing mechanism is brought into action and the ring-core is rotated at high speed by power during the subsequent action of the smoothing, shaping, forming or spinning-rolls.

In this connection the specification says:

> "I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at two hundred and seven turns a minute. By this means the machine not only does more work in a given time but it does better work." (P. 2, lines 4 to 11.)

Before referring to the spinning-rolls which shape and form the skirts of the fabric to the sides of the core smoothly, uniformly and accurately, I will call attention to the tread-forming roll 141 shown in Fig. 12ª. The tread-forming-roll is brought to bear upon the middle portion of the fabric applied to the ring-core while the ring-core is rotated at its fast speed. In this connection the specification says:

> "In the case of the tread-forming-roll 141, this permits the operator to gradually bring the proper amount of pressure to bear on the canvas either which lies under or which actually forms the tire tread to thoroughly smooth it and shape it to the core." (P. 5, lines 54 to 60.)

While the core is rotating at its fast speed, the skirts of the fabric are applied, cemented, shaped and formed

to the sides of the core by means of the forming- or spinning-rolls 147, best shown in Figs. 9, 12^b and 12^c. There is a pair of these spinning-rolls which simultaneously act upon opposite sides of the core, and upon the respective skirts of the fabric, as illustrated in these figures, so that both skirts of the fabric are simultaneously applied and shaped to the core. These forming- or spinning-rolls are supported by a sliding carriage which is movable radially with respect to the rotating core. This carriage is moved inwardly by a screw feed so that the forming- or spinning-rolls are gradually fed inwardly as the core rotates. Also, each forming- or spinning-roll is pressed toward the core so as to press forcibly upon the portion of the fabric which it bears against.

The sliding carriage for the forming- or spinning-rolls is shown at 123 in Fig. 6. It is mounted to slide radially with respect to the core upon the housing or standard 118. It is gradually advanced by a feed screw controlled by a hand-wheel 124. The workman turns this hand-wheel and thereby gradually feeds the carriage for the forming- or spinning-rolls radially inward.

The forming- or spinning-rolls are not directly carried by the sliding carriage, but are mounted upon a rotatable head or turret 131, shown in Fig. 9, which turns on the sliding carriage. As shown in Fig. 9, this rotatable head or turret not only carries the forming- or spinning-rolls, but also the tread-roll 141, bead-applying-rolls 156, 158, and trimming cutters 149. By turning the turret any one of this set of tools can be brought into co-action with the core. The turret is locked in any one of its positions on the sliding carriage by the locking mechanism illustrated in Fig. 8.

As shown in Fig. 9, each forming- or spinning-roll 147 is rotatably mounted on one end of a lever pivoted at 143 to the turret. Each of these levers is acted upon by

a spring 145 which presses the corresponding forming- or spinning-roll against the fabric on the core. Concerning these springs the specification says:

> "The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, strong spiral springs may be used." (P. 5, lines 108 to 113.)

The specification further states that weights can be substituted for the springs, in which connection it says:

> "And it is of course understood that there may be substituted for the springs and as an equivalent therefor the more cumbersome device of a weight constantly tending to force the spinning-rolls, with considerable pressure, toward the ring-core." (P. 5, lines 121 to 127.)

Indeed, the spinning-rolls may be pressed toward the core in other ways, the specification saying:

> "In a broader aspect of my invention, however, I may employ mechanical instrumentalities, not the hands of the operator, other than springs or weights for pressing the spinning-rolls laterally against the ring-core. I shall, then, use the term 'power-pressed' to cover generally not only springs and weights but other mechanical instrumentalities for pressing the spinning-rolls against the ring-core. When I refer to my spinning-rolls as laterally yielding and no more, I mean to include any source of power for pressing the spinning-rolls against the ring-core, even the comparatively inefficient and irregular power contained in the hands of the operator." (P. 6, lines 2 to 17.)

As shown in the drawings, each forming- or spinning-roll has a rounded working edge, and concerning this the specification says:

> "While I have shown these spinning-rolls as disk-shaped throughout, it will naturally be understood that the disk-like or narrow character of the rolls is only essential at the periphery which is rounded and not sharp so as not to cut the fabric." (P. 6, lines 17 to 23.)

As I have previously pointed out, after the flat fabric has been stretched upon the slowly rotating ring-core and cemented thereto along the tread zone, the ring-core is then rotated at a high speed, the specification giving as an illustration two hundred and seven turns a minute. The effect of this high speed is to throw out the unattached sides or skirts of the fabric by centrifugal force, somewhat as indicated in Figs. 12^a and 12^b of the patent drawings. The result is that the skirts of the fabric are projected outwardly in a stiff and smooth condition, thereby eliminating any tendency to fold, gather, pucker or wrinkle. The forming- or spinning-rolls are then brought into action and each roll initially presses and acts upon the hinge of the corresponding skirt. That is to say, the fabric adheres to the tread zone of the core at each side and the unattached portion of the fabric is thrown out by centrifugal force at the line where the adherence between the fabric and the core ceases, and this line constitutes a hinge on which the outstanding skirt turns. It is at this hinge line that the effective action of each forming- or spinning-roll takes place. As shown, for example in Fig. 12^b of the patent, each forming- or spinning-roll presses against the fabric at this hinge line, thus forcing the area of the fabric with which it is immediately in contact against the core and causing it to adhere thereto. The unattached skirt is forced

outwardly by centrifugal force in opposition to the inward pressure of the forming- or spinning-roll. The effect is as though the margins of the skirt were being pulled outwardly by invisible fingers against whose pull the spinning-rolls must act in forcing the fabric at the hinges against the core. The cementing or adhesive action of the rubber compound in the fabric, as the fabric is forcibly pressed against the core, causes the fabric to adhere to the core so strongly that the centrifugal force cannot detach the fabric when once it has adhered to the core.

As the core rapidly rotates, the forming or spinning-rolls are fed gradually inwardly with the result that each spinning-roll traces a spiral path with respect to the core and the fabric thereon. By reason of the rapid rotation of the core and the gradual progressive advance of the spinning-roll, the successive convolutions of this spiral path may be brought so close together that each spinning-roll can act successively only upon small or elemental areas of the fabric. Assume, for example, that at each rotation of the core the spinning-rolls are fed inwardly one-eighth of an inch, then each spinning-roll, as the ring-core advances, acts successively on portions of the fabric extending radially only one-eighth of an inch beyond the hinge line between the adhering portion of the fabric and the outwardly flying skirt; and circumferentially to the extent which the periphery of the spinning-roll is in contact with the fabric. Accordingly the action for each spinning-roll is to fold down against the core successive small areas of the fabric. The pressure exerted by each spinning-roll upon this area of fabric causes it to adhere to the core as it is folded against the core and owing to the adhesive property of the rubber compound, the centrifugal force is not sufficient to detach it.

In this way, each spinning-roll acts progressively both circumferentially and radially to fold small successive

areas of fabric at its hinge line against the core until the entire skirts are laid snugly, smoothly, uniformly and accurately against the side surfaces of the core to which the fabric should conform.

During this folding action, the centrifugal force acting in opposition to the inward pressure of the forming- or spinning-rolls maintains the unattached portions of the skirts smooth and wrinkle-free, with the result that the formation of wrinkles in the applied fabric is prevented.

Since the action of each spinning-roll on the fabric is predominantly circumferential, owing to the gradual progressive radial advance, the radial component of movement of each spinning-roll is small as compared with the circumferential advance of the core, it might even seem as though the effect would be to stretch the fabric circumferentially and not radially (just the opposite of what is desired), nevertheless the fact is that the fabric is stretched radially and not circumferentially. That is to say, the ultimate effect is that shown in my second diagram, "Fabric Shaped to Core", namely, that at each inner margin or bead zone the reticulations of the fabric are converted into diamonds or lozenges, the long diameter of which is radial and the short diameter circumferential. The characteristic features of the action of the machine in attaching the skirts of the fabric smoothly to the sides of the core, after the initial circumferential stretch, may be recapitulated as follows:

1. *Centrifugal force* due to the high speed of the core which holds the skirts of the fabric under tension away from the core in a stiff and smooth condition and in a direction lateral to the plane of rotation of the core, said tension being sufficient to produce radial stretching when each skirt is acted upon by the forming- or spinning-roll.

2. *The progressive advance* of the forming- or spinning-rolls which establishes one base or hinging line along one portion of its spiral path and then a new base or hinging line along the next portion of the spiral until the sides are finished.

3. *The hinging or folding action* of the fabric over such small areas that the fabric will contract circumferentially and be laid down wrinkle-free along the zone of the narrow advance.

4. *The cementing or adhesive action* of the rubber compound which holds the fabric firmly to the core when once strongly pressed thereagainst.

The ultimate effect is the re-arrangement of the threads or cords of the fabric so that all portions of the fabric are smoothly and uniformly attached to the core.

The machine of the State patent in suit is so organized and constructed that a previously unshaped, flat fabric strip from a supply or stock-roll is uniformly stretched at its middle or tread portion upon a ring-core when rotating at the power-driven slow speed. After this middle or tread portion has been applied, the ring-core is rotated at high speed by the power-drive mechanism of the machine. During this high speed rotation, the fabric is shaped and applied to the ring-core beyond the tread portion at each side. The effect of the high speed of the ring-core is to throw out from its sides by centrifugal force the unapplied fabric portion. The forming- or spinning-rolls are carried by a support which is so mechanically mounted and fed as to ensure its radial movement with a gradual progressive advance in proper relation to the fast rotating ring-core. The forming- or spinning-rolls are pressed against the ring-core during such gradual radial advance, so that each spinning-roll

acts gradually upon the centrifugally thrown-out fabric, thereby shaping it to the side of the rotating ring-core while bringing the fabric into adhesive contact therewith.

There is one specific feature of the machine of the State patent in suit which I have not yet mentioned. As shown in Figs. 9, 12^b and 12^c, the plane of rotation of each forming- or spinning-roll is not perpendicular to the plane of rotation of the ring-core, but is at a receding angle thereto. Concerning this the specification says:

> "It will be noted finally that I mount the spinning-rolls with their plane not at a right angle to but to recede at an acute angle from the plane of the ring-core. The effect is when the ring-core is rotating at high-speed, the centrifugal force tends to throw the fabric out at a right angle from the core-plane and unless the roller recedes in the manner shown, the fabric will become entangled with it." (P. 6, lines 33 to 42.)

The machines which I have seen in use at the Goodyear Tire & Rubber Company's factory at Akron, Ohio, so far as relates to the fabric supply, the high and low speeds, the speed changing mechanism, the spinning-rolls, and the gradually fed support or carriage for said rolls, are organized and constructed in all substantial respects like the machine illustrated in the State patent in suit, and act in the same way. The same is true of the similar machine which I examined and witnessed in action at the United States Court House in Cincinnati, Ohio, on the occasion of the hearing before the Circuit Court of Appeals, in the Firestone suit.

[The two diagrams referred to by witness are introduced in evidence and entitled, respectively, "Plaintiff's Exhibit No. 4, Original Flat Fabric Before Shaping", and "Plaintiff's Exhibit No. 5, Fabric Shaped to Core".]

Q. 9. Referring now to defendant's machine as exhibited to you on March 18, 1919, will you kindly compare its construction and mode of operation with the construction and mode of operation of the State patent and State machine as set forth by you in your last answer. You may, if you please, refer in this connection to the disclosure given in the Thropp & DeLaski Patent No. 1,119,326 you have already referred to.

A. I will use the Thropp & DeLaski Patent No. 1,119,326, December 1, 1914, in describing the defendant's machine, and when I use reference numerals they will be those of this patent.

Defendant's machine has a rotatable ring core 101 which is detachably mounted upon one end of a rotating shaft shown at 8 in Fig. 2 of the drawings of said Thropp & DeLaski patent. This shaft is power driven, and there is a speed changing mechanism which enables the core to be driven in succession at low and high speed. This speed changing mechanism is illustrated in Fig. 2 and is described in detail beginning at line 83 page 1 of the Thropp & DeLaski patent.

I timed the two speeds of the defendant's machine which I examined. The high speed was in excess of 120 revolutions per minute, approximately 125 r.p.m. The low speed was one-tenth of the high speed.

The ring-core is driven at low speed during the initial application of the tire fabric; and it is rotated at high speed during the action of the forming- or spinning-rolls.

As shown in the Thropp & DeLaski patent, the flat tire fabric comes from a supply roll 66. The fabric passes from the supply roll 66, as shown in Fig. 7, around the guide roll 71, over tension roll 68, thence under a second guide roll 69 to the ring-core against which the leading end of the fabric is pressed. The fabric is impregnated or coated with an adhesive rubber compound so that the leading end adheres to the core. The rotation of the ten-

sion roll 68 is retarded by a brake band 73 (Fig. 2). Accordingly, as the ring-core slowly rotates, it pulls off the fabric from the supply roll against the resistance of the tension roll, with the result that the fabric is stretched uniformly longitudinally at the middle or tread zone of the ring core.

After one complete revolution of the ring-core, the machine is stopped and the workman overlaps the last end of the fabric strip over the leading end.

Thus at the conclusion of the slow speed rotation the middle of the fabric is stretched upon the tread zone of the core, conforming to the shape thereof, and adheres to the core. The skirts or side portions of the fabric are unattached, loose and baggy. The workman then shifts the speed changing mechanism so that the core is driven at high speed. This speed is such that the unattached skirts of the fabric are thrown out stiffly and smoothly by centrifugal force. Each unattached skirt swings outwardly at the hinge between it and the attached middle portion of the fabric.

The outflying skirts of the fabric are then acted upon by the forming or spinning rolls 132. As I have heretofore stated, these forming or spinning rolls are mounted in the manner shown in Figs. 14 and 15 of the Thropp & DeLaski patent. As therein shown, each roll 132 is rotatably mounted in a bracket 129 carried by a curved plate 122, which is capable of sliding in a curved path upon a lever 97, being locked to that plate by screw 125. Each lever 97 is pivoted at 98 to a sliding carriage 85. This carriage 85 is mounted to slide radially with respect to the core upon a supporting guideway 83. This carriage 85 is fed gradually and progressively inward by means of a feed screw 86, which is best shown in Fig. 5. This feed screw can be turned by a hand-wheel 88, but as I witnessed the defendant's machine in operation, the feed screw was rotated automatically by the power drive mechanism,

such as illustrated and described in the Thropp & DeLaski patent.

Each forming- or spinning-roll 132 when in action is forcibly pressed toward the ring-core and against the fabric applied thereto by means of a weight 103, best shown in Fig. 5. Accordingly, as the ring-core rapidly rotates and the forming- or spinning-roll carriage is gradually advanced, each spinning-roll is forcibly pressed upon one skirt of the fabric at the hinged line between said outflying skirt and the attached portion of the fabric.

The consequence is that the inwardly pressing forming- or spinning-rolls act in opposition to the pull of the fabric skirts under the action of centrifugal force. As the ring-core rotates rapidly and the forming- or spinning-rolls feed gradually inward, each roll traces a spiral path on the fabric, the successive convolutions of this spiral path being close together, about one-sixth of an inch apart as nearly as I could estimate.

Accordingly, each forming- or spinning-roll acts successively upon small areas of the outflying fabric skirt, folding the same down at the hinge line against the core and causing by pressure each successive area to adhere to the core, due to the adhesive property of the rubber compound. This adhesion is adequate to retain the fabric against the outward pull of centrifugal force.

This action continues until the skirts of the fabric are shaped and formed to the sides of the core and are caused to adhere thereto.

Each forming- or spinning-roll 132 has a rounded working edge. Also, as shown in Fig. 14, which illustrates the normal position of the forming- or spinning-rolls relatively to the ring-core, the plane of each forming- or spinning-roll is at a receding angle to the plane of rotation of the ring-core, so that the outflying fabric skirts do not conflict with the rolls.

In the respects to which I have referred, the defend-

ant's machine is similar to the machine of the State patent in suit.

In both machines there is a ring-core driven by power first by a low speed mechanism and then by a high speed mechanism. In both machines there is a speed changing mechanism to enable the machine to be power driven at the two different speeds. In each machine the previously unshaped fabric strip is first stretched along its middle or tread portion onto the ring-core when such ring-core is rotating at slow speed.

Thereafter in each machine the skirts of the fabric beyond the tread portion are shaped to the sides of the ring core by means of the forming- or spinning-rolls. In each machine during the action of the forming- or spinning-rolls, the ring core is rotated at so high a speed that the skirts of the fabric are thrown stiffly and smoothly outward by centrifugal force.

In each machine the forming- or spinning-rolls are mounted upon a support or carriage which is in turn so mechanically mounted on the machine as to insure the radial movement of the forming- or spinning-rolls with a gradual advance in proper relation to the fast rotating ring core. During such gradual advance, each forming- or spinning-roll in each machine is pressed toward the core and it acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core by bringing it into adhesive contact therewith.

In each machine the effect of each forming- or spinning-roll is to form or shape the portion of the fabric acted upon by it to the side of the core, the reticulations of the fabric being elongated radially and contracted circumferentially.

Mechanically considered, the defendant's machine resembles the State patent in the following respects:

There is a rotating power driven ring-core. There is a low speed mechanism, a high speed mechanism, and

speed changing mechanism, so that the ring-core may be power driven both at low speed and at high speed.

There is a stock roll for the unformed flat sheet fabric and tension mechanism between the stock roll and the ring-core, so that the sheet fabric can be uniformly stretched circumferentially when applied to the ring-core.

There are two forming- or spinning-rolls which simultaneously act upon the opposite sides of the ring-core and against the hinges of the sides of the fabric where the unattached portions join the attached portions.

Each forming or spinning roll is carried by a swinging arm and is forcibly pressed against the fabric upon the core. Defendant gets this pressure by means of a weight, and while the State patent shows a spring for this purpose, it specifically says that a weight may be used.

The spinning-rolls are mounted upon a sliding carriage. This sliding carriage is mechanically mounted and accurately guided upon the machine so as to move radially with respect to the ring-core.

The sliding carriage is fed by a screw so that it is gradually and progressively advanced as the forming- or spinning-rolls press against the rapidly rotating ring-core.

Each spinning-roll has a rounded working edge.

Each spinning-roll is set at a receding angle with respect to the ring-core.

The forming and shaping of the skirts of the fabric at the sides of the core and the cementing of the fabric to the core in a smooth and unwrinkled condition are effected in the same way, both in the machine of the State patent and in the defendant's machine.

In the defendant's machine, as in the machine of the State patent, the skirts of the fabric are held stiffly and smoothly away from the core by centrifugal force, and under tension sufficiently to produce a radial stretching when acted upon by the spinning rolls; each forming- or

spinning-roll progressively advances in a spiral path, thereby establishing successive base or hinge lines where the outflying fabric skirts join the attached portion of the fabric; the fabric is successively folded down at small areas against the core so that the fabric contracts circumferentially and is laid down wrinkle-free along the zone of the narrow advance of the forming- or spinning-rolls; and due to the cementing or adhesive action of the rubber compound, the fabric is held firmly to the core when once strongly pressed thereagainst.

The ultimate result is to rearrange the reticulations of the fabric uniformly throughout the circumference of the tire, with the long dimensions circumferential at the tread zone and the long dimensions radial at the bead zone.

Q. 10. You may state whether or not you observed in defendant's machine any points of construction or operation different from those in the State patent and machine.

A. Yes, I noted a number of differences to which I will call attention.

In the defendant's machine the head which carries the fabric stock roll is vertically adjustable and the stock rolls are directly above the ring-core.

Defendant's machine does not use any tread roll like that shown at 141 in Figs. 9 and 12[a] of the State patent.

In defendant's machine there is an automatic feed for the carriage which supports the forming- or spinning-rolls, whereas in the State machine the feed screw is turned by hand. But the defendant's machine does have a hand-wheel by means of which the feed screw for the roll carriage can be fed.

Defendant's machine has an automatic stop motion which is arranged so that it can stop the advance of the forming roll carriage at any desired place.

Defendant's machine has an adjustable pointed gauge to indicate to the workman that the forming rolls have

reached a position where it may be desirable to have the advance of the carriage stopped.

In defendant's machine, as shown in Fig. 14 of the Thropp & DeLaski patent, the supporting plates 122 for the forming- or spinning-rolls are movable in a curved path so that the rolls may be adjusted to the position shown in dotted lines, or to any intervening position. This enables the plane of rotation of the rolls to be changed relatively to the plane of rotation of the core.

The swinging levers 97 shown in Fig. 14 of the Thropp & DeLaski patent and used in defendant's machine, have outwardly projecting arms 108 each with a set screw 118, by means of which each lever can be connected to a rod 110. Each of the two rods 110 is pivoted to a wheel 111 which can be turned by a screw 114 on the hand rotated shaft 115. By clamping the set screws 118, the levers 97 can be swung by hand. This enables the workman to move the forming or spinning rolls away from the core and also enables the workman to press the forming- or spinning-rolls by hand power against the fabric layers upon the ring-core.

In the State machine the levers carrying the forming or spinning rolls are mounted upon a turn table or turret revolving on the carriage, this turn table also carrying bead forming rolls and trimming cutters, as well as the tread forming roll.

Defendant's machine does not have the bead forming rolls; and its trimming cutters, shown at 151 in Fig. 8 of the Thropp & DeLaski patent are mounted upon an independent frame 140 which can be swung in and out of operative position.

Defendant's machine has special detachable bead rings 162, as shown on Sheet 6 of the Thropp & DeLaski patent drawings, and which are clamped to the ring-core before the beads are put in place. The State patent does not disclose any such rings.

In defendant's machine the forming- or spinning-rolls 132 are greater in diameter than the ring-core in cross section, and hence are relatively larger than the corresponding forming- or spinning-rolls of the State patent.

These are the principal features of difference which I have noted.

There are various differences in specific details of mechanical construction to which it seems unnecessary to call attention.

Direct-examination closed.

MARCH 26, 1919.

CROSS-EXAMINATION BY MR. SEWARD.

x-Q. 1. Give the names of the cases relating to the manufacture of tires in which you have testified as an expert.

A. I have forgotten the titles of the cases. One was for the Pennsylvania Rubber Co., and two others were for the Republic Co.

x-Q. 2. Did the cases for the Republic Co. have to do with the non-skid tread?

A. Yes.

x-Q. 3. And in the case for the Pa. Co. for the non-skid tread?

A. No.

x-Q. 4. What did the last named case have to do with?

A. With the clincher type of tire.

x-Q. 5. What sort of a patent was the patent in suit?

A. The patent in suit was one of the early pneumatic bicycle tire patents which the plaintiff endeavored to assert covered all clencher tires used in automobiles.

x-Q. 6. Were any of the tire making machines you saw at the Goodyear plant like the Goodyear machine you saw operated in the Federal Building at Cincinnati?

A. Yes, so far as concerns the stretching of the tire fabric on the tire and the forming of the sides of the fabric on the rapidly rotating ring core.

x-Q. 7. Were they the same in mechanical structure?

A. No.

x-Q. 8. In the description which you have given of the construction and operation of the machine of the patent in suit, have you been giving your understanding of the patent, as modified by the disclaimer?

A. Yes.

x-Q. 9. Do you say that the machine shown in the patent in suit has mechanism for imparting a high rotating speed and a low rotating speed to the core?

A. Yes.

x-Q. 10. Will you please describe the parts which are adapted to give those speeds, referring to the figures of the drawings in which they are shown?

A. As shown in Figs. 1 and 5 of the drawings of the State patent in suit, the machine is driven by a motor 49. This motor has a sprocket wheel 50, around which passes a sprocket chain 51, which likewise passes around a sprocket wheel 52 on a shaft 53. This shaft 53 is utilized to drive the two ring cores with which the machine is equipped, but as these intermediate drives are duplicates, it will suffice to refer to one only of them. The shaft 53 has a sprocket wheel 55, which through a sprocket chain 56 drives a clutch sleeve 57, which is loose on a shaft 58. Splined to the shaft 58 is a sliding clutch sleeve 59, which is under the control of a clutch lever 59′, by means of which the shaft 58 may be rotated or stand still at the option of the workman. As shown in Fig. 4, the shaft 58 has a slow worm 76, which meshes with a spiral gear 75, which is loose on shaft 70. Splined to this shaft 70 is a sliding clutch sleeve 71, which can be slid along the shaft 70 by a shifting lever 86. This clutch sleeve 71 has clutch teeth on one side, which are adapted to engage clutch teeth on a sleeve 72, which is

fast with the spiral gear 75. When the clutch sleeve 71 engages the sleeve 72, the slowly rotating spiral gear 75 rotates the shaft 70 slowly. The shaft 70 carries a gear wheel 88, shown on Fig. 3. This gear 88, as shown in Fig. 5, meshes with the gear 89 on shaft 90, and it is this shaft 90, as shown in Fig. 1, which detachably carries the ring core. Accordingly in this way the ring core is driven at slow speed, the specification giving six revolutions a minute as an example.

The clutch sleeve 71 also has clutch teeth adapted to engage clutch teeth on a sleeve 73, when the sleeve 71 is moved to the right, as shown in Fig. 3. This sleeve 73 has fast on it a spiral gear 83. Consequently, when the clutch sleeves 71 and 73 are interlocked, the power transmitted through the spiral gear 83 rotates the shaft 70 and hence the ring core. The spiral gear 83 meshes with a worm 82 on a shaft 78, which is driven from the shaft 58 by a sprocket chain 80.

The drawings do not illustrate the face of the worm 82, but it is a high speed worm, since through it rapid rotation is imparted to the shaft 70, the specification giving as an example 207 turns a minute.

x-Q. 11. Have you any authority in the specification or drawings, other than that mentioned by you, for saying that the worm 82 is a high speed worm?

A. No.

x-Q. 12. The specification of the patent says does it not, near the bottom of the second column of page 3, "The clutch member 72 is provided with a hub 74 rigidly secured to a spiral gear 75 adapted to be driven by means of a worm 76 mounted on the shaft 58 just as the corresponding clutch member 73 has a hub 84 secured to a spiral pinion 83 driven by a worm 82 on a shaft 78". Does that description indicate that there is any difference in the two worms 76 and 82?

A. No, that sentence is only a detached part of the description.

x-Q. 13. Please refer to any other part of the description that has to do with the form or relative form of the worms 76 and 82.

A. The very next sentence to the one quoted by you reads:

> The shaft 78 is driven from the shaft 58 by a chain and sprocket connection and the arrangement is such that the spiral gear 83 rotates much more rapidly than the spiral gear 75.

Accordingly, it is only a question of such an arrangement of the gearing as to give the speed differential to which the patent repeatedly refers.

Such an arrangement of gearing is well known to all skilled mechanics. Of course, if one pair of gears is to produce a slow speed and another pair of spiral gears is to produce a high speed, the skilled mechanic knows that he is to have a slow drive worm in one case and a fast drive worm in the second case.

x-Q. 14. But the patent says nothing about a high speed worm and a low speed worm, does it?

A. No, it leaves that to the intelligence of the mechanic.

x-Q. 15. I call your attention to page 4 of the patent, line 77, where it says in the middle of a sentence "I employ a slow-speed mechanism, in this case represented by the clutch member 73, and a fast-speed mechanism, here represented by a clutch member 72," and would ask you whether or not your answer is consistent with that statement.

A. No, my answer is inconsistent with this statement, which in turn is inconsistent with the statement at lines 1 to 4, of page 4. The scrivener of the patent at this point has simply got his reference characters wrong. He has

transposed his 72 and his 73. Or, perhaps, his reference characters 83 and 75 are transposed at lines 1 to 4 of page 4.

x-Q. 16. You have said that the worm 76 is shown as a slow speed worm, and that the drive of the shaft 70 received from the said worm through the gear 75 and connected parts constitutes the slow speed drive of the shaft 70 and hence of the core. Do you desire to change that answer?

A. No.

x-Q. 17. The shaft 78 is driven from the shaft 58 by the sprocket chain 80. Is that correct?

A. Yes. Consequently, as shown in Fig. 3 because the sliding sprocket wheel 79 is smaller than the driven sprocket wheel on the shaft 78, said shaft 78 rotates somewhat more slowly than shaft 58.

x-Q. 18. And the ratio of rotating speed of the shaft 58 to the shaft 78 is about 3 to 2, isn't it?

A. Yes, about that.

x-Q. 19. So that the worm on the shaft 78 is driven more slowly than the worm on the shaft 58?

A. Yes.

x-Q. 20. Therefore, is it not a fact, that if a high speed worm were placed on the shaft 78, it would have to compensate for the difference in rotative speed of the shafts 58 and 78 before it could make the gear 83 rotate as rapidly as the gear 75?

A. Yes.

x-Q. 21. The ratio of low speed to high speed mentioned in the specification of the State patent when it refers to the number of revolutions preferred for the low speed and the number for the high speed is about 1 to 34, isn't it?

A. Yes.

x-Q. 22. Do you maintain that you could obtain that

difference in speed from the construction shown in Fig. 3 by employing a high speed worm on shaft 78?

A. Yes.

x-Q. 23. Do you know what would be the pitch of the said worm?

A. It would be about 50 times the pitch of the worm 76.

x-Q. 24. Do you notice that the face of the gears 75 and 83 show substantially the same curve?

A. The illustration of Fig. 3 shows no difference between the worm teeth illustrated, but the showing in this respect is merely conventional and perhaps the draftsman can hardly do more than he has done in making such a conventional illustration of the gearing.

x-Q. 25. If one of the worms had a pitch about 50 times that of the other, would there be a difference in the curvature of the faces of the gears 75 and 83?

A. Yes.

x-Q. 26. Can you give any reason why the shaft 78 is driven at a lower speed than the shaft 58 if the shaft 78 is intended to impart the high speed to the shaft 70?

A. No.

x-Q. 27. And I understand you to agree that there is no part of the patent which specifically states that there is any difference in the worms 76 and 82. Is that correct?

A. None, excepting that the specification says that the arrangement is such that the spiral gear 83 rotates much more rapidly than the spiral gear 75, and, therefore, any skilled mechanic would know that the speed difference must be obtained by difference in pitch between the two worms 76 and 82. I note further that the specification says "But when I use the terms fast speed mechanism and slow speed mechanism and speed changing mechanism in the claims, it is understood I mean any class of mechanism accomplishing these functions and not merely the specific mechanism herein shown" (page 4, lines 83-88).

Such speed changing mechanism has long been known in the mechanical art.

x-Q. 28. I call your attention to page 4 of the specification, line 8, where it says "By throwing the clutch member 71, which is splined on the shaft 70, into connection with either the clutch member 73 or 72, the shaft 70 is made to revolve slowly or rapidly". Does not that indicate that the clutch member 73 and its gear 83 are part of the slow speed mechanism?

A. No.

x-Q. 29. If the shaft 70 is made to revolve slowly, it makes the core revolve slowly, doesn't it?

A. Yes.

x-Q. 30. In other words, the rotative speed of the core depends upon the rotative speed of the shaft 70?

A. Yes.

x-Q. 31. Will you state what you understand the sentence I have last quoted to mean. That is, the sentence beginning on line 8 of page 4.

A. It means that by the employment of clutch cooperating with the clutch faces on the two spiral gears, either a fast speed or a slow speed can be obtained.

x-Q. 32. But you don't understand it to mean that the slow speed is obtained through the clutch member 73.

A. No, because that is on the spiral gear 83, which the specification has already stated rotates much more rapidly than the spiral gear 75.

x-Q. 33. But you have agreed, I understand, that the scrivener of the patent may have reversed his reference numerals in lines 2 and 4 of page 4. Am I correct in that?

A. Yes, except I think it is much more probable that he has transposed the numerals at lines 79 and 80, since he shows in Fig. 4 that the worm 76 is one of small pitch, which would drive the spiral gear 75 and the shaft 70 slowly.

x-Q. 34. Have you seen any machine like that of the

patent in suit in which the ratio of low speed drive of the core to high speed drive was as great as 1 to 34?

A. No, excepting possibly the machine which I saw in operation at the Courthouse in Cincinnati. As to that, I did not note the ratio of speeds.

x-Q. 35. What was the ratio on the machines of the patent in suit which you examined for that point?

A. I did not observe the exact ratio, but I think it was in the neighborhood of between 10 and 15 to 1.

x-Q. 36. The high speed in the case last mentioned was not over 130 or 135 revolutions per minute, was it?

A. I was informed that the high speed of the Goodyear machines is between 120 and 150 per minute, and this accords with my observation of the machines.

x-Q. 37. Do you believe that the said machines, I mean the machines of the patent in suit, would be operative if the core had a high speed rotation of 207 R.P.M.

A. Yes.

x-Q. 38. Did you ever make a test to find out if your belief is right or not?

A. No.

x-Q. 39. What do you understand is the function of the tread roller 141 of the patent in suit?

A. The specification says:

> In the case of the tread forming roll 141 this permits the operator to gradually bring the proper amount of pressure to bear on the canvas either which lies under or which actually forms the tire tread to thoroughly smooth and shape it to the core. (page 5, lines 54-60.)

I understand this is the function of the tread roll.

x-Q. 40. Then you understand that one function of the tread roller is to shape the fabric to the core, is that correct?

A. Yes.

x-Q. 41. Do you understand that a function of the tread roller is to remove longitudinal wrinkles which may be formed in the fabric on the tread of the core?

A. No. I have never observed any longitudinal wrinkles in the fabric stretched on the core.

x-Q. 42. I mean, do you understand the tread roll is described in the patent in suit as having that function?

A. In this connection the specification says: "It will thus be clear that after the operator has drawn a layer of rubber coated canvas onto the ring core, he can, by pressing the tread forming roll 141 against the fabric, smooth and shape the fabric on the core and get it free of captured air bubbles or wrinkles over its outer face." (page 5, lines 82 to 88.)

Accordingly, the specification does describe the function of the tread roll to remove any wrinkles which may occur.

x-Q. 43. If a wrinkle should occur in the fabric that had been stuck on the tread portion of the core by the stretching operation, would the tread roller be able to remove said wrinkle and smooth the fabric on the core?

A. I do not know.

x-Q. 44. Does the patent in suit state anywhere how much tension or how much stretch should be given to the fabric led from the supply roll to the core?

A. No.

x-Q. 45. What do you mean in your direct testimony by the tread portion of the core?

A. The peripheral portion.

x-Q. 46. How much of the peripheral portion in a lateral direction?

A. Whatever portion is covered by the fabric when it is stretched on the core and revolving at low speed.

x-Q. 47. Then the definition of that expression used by you may not always be the same. Is that correct?

A. Yes.

x-Q. 48. Does it always mean that part of the periphery of the core which lies outside, in a radial direction, the median line referred to by you and shown in your diagram entitled "Fabric Shaped to Core"?

A. Yes.

x-Q. 49. And the distance of the median line from the axis of the core, in a radial direction, would depend upon the amount of stretch given to the fabric while being applied to the core at slow rotation.

A. Yes.

[RECESS.]

x-Q. 50. Is it a fact that the patent in suit shows and describes that, as a result of the tension or stretch on the fabric during the slow rotation of the core, the fabric is applied to a part of the periphery of the core which is less in width than the length of the adjacent face of the tread roll?

A. I do not note that the specification says anything about this. Fig. 12[a] shows the tread roll of greater length than the portion of the fabric which is in contact with the core, and on this showing I answer the question in the affirmative.

x-Q. 51. The specification of the patent indicates that Fig. 12 shows the fabric after it has been first applied to the core and before the tread roll 141 has acted upon it. Is that a fact?

A. No, I think this shows the beginning of the operation, when the leading edge of the fabric is first applied to the core and before any rotation begins at all.

x-Q. 52. Do you understand that the extreme periphery of the core is coated with an adhesive cement before the fabric is attached thereto at the beginning of the operation?

A. Yes, the specification says at page 3, line 55, that

in order that the ring core "may take hold of the fabric, the core is coated with rubber or cement".

x-Q. 53. Do you understand that it is practical to coat the extreme periphery of the core, or to coat the whole outside of the core upon which the fabric is to lie, with cement in making the tire?

A. It is quite unnecessary to coat the entire core. It is enough that there be sufficient adhesion between the leading end of the fabric and the core, so that the fabric will adhere to the core without slipping at the beginning of the operation. If the rubber compound in the fabric is sufficiently adhesive, no additional application of adhesive to the core is necessary.

x-Q. 54. Do you understand that it is the practice to apply an adhesive to the outer periphery of the core in this operation?

A. Yes, occasionally.

x-Q. 55. What is your understanding of the regular practice?

A. My observation in the Goodyear plant is that in most instances the condition of the fabric is such that no additional adhesive is required. In some instances apparently depending upon the judgment of the workman and the condition of the fabric, he places a narrow strip of soft rubber on the core, using it as an adhesive to cement to the core the leading end of the fabric.

x-Q. 56. Where does he place this strip of rubber, on the outer periphery, or on the side of the core?

A. On the outer periphery and extending partly down the sides of the core.

x-Q. 57. In your judgment, if the fabric were only applied to as much of the core as it is shown to be in contact with, in Fig. 12 of the patent, would there be sufficient adhesion between the fabric and the core to withstand the strain of the tension on the fabric?

A. There would not.

x-Q. 58. Look at Fig. 12[c] of the patent drawings, if you please, and tell me whether or not the rolls 147 could stitch the fabric into the creases of the core? I mean all the way in.

A. That would depend upon whether the lever arm 144 would be stopped by contact with the fabric before the rolls had pressed the margins of the fabric all the way in. I think as the draftsman has here shown, the movement of the arm 144 would be stopped before the rolls pressed the margin of the fabric all the way in.

x-Q. 59. If the fabric were applied to the core as indicated in Fig. 12[a], and then the roller 141 removed from contact with the fabric, with the core rotating at a speed of about 207 r.p.m., what do you think would happen with respect to the fabric remaining in adhesion with the core?

A. I think it would still remain in adhesion to the core.

x-Q. 60. Do you think that adhesion would be throughout the width shown in Fig. 12[a]?

A. Yes.

x-Q. 61. Then how, according to the patent, would the margins of the fabric be applied to the core?

A. By the gradual advance and inward pressure of the forming rolls 147.

x-Q. 62*a*. Do you believe that those rolls could smoothly form the fabric down?

A. Yes.

x-Q. 62*b*. Would that operation of the rolls 147 be such an operation as you have mentioned in your direct examination as being a characteristic of the operation of the machine of the patent in suit?

A. Yes.

x-Q. 62*c*. In that operation you would have a radial stretch exerted on the fabric at a point outside of, in a

radial direction, the point of extreme width of the core?

A. Yes.

x-Q. 63*a*. I want to call your attention once more to the mechanism for imparting high and low speed to the core. By the word "pitch", when we were speaking of the worms 76 and 82, did you intend to mean the distance traveled in a direction parallel with the axis of the worm by one complete turn of the worm thread?

A. Yes.

x-Q. 63*b*. That is how the word "pitch" is generally understood, is it not?

A. Yes.

x-Q. 63*c*. Will you look at Fig. 4 of the patent and say whether I am correct in stating that the pitch of the worm 76 on the scale of that figure of the drawing is about 1/12 of an inch?

A. I should think that is an approximately correct estimate.

x-Q. 64*a*. Then a worm having a pitch fifty times that of the worm 76 would have a pitch of about 4–1/6 inches on the scale of Fig. 4. Is that correct?

A. It is a question of angle rather than of the actual dimension in inches which is important. The pitch of the worm 76 is such that at each revolution of the shaft 58 the spiral gear 75 is advanced one tooth. By increasing the angle of the teeth on the drive worm 76, a greater angular movement will be given to the driven spiral gear 75. And by changing this angle of the teeth on the driving worm with corresponding changes in the shape of the teeth on the driven spiral gear, the spiral gear would be driven more and more rapidly.

x-Q. 64*b*. Can't you answer my last question yes or no?

A. I answer it—no.

x-Q. 64*c*. When you refer to increasing the angle of the worm 76, do you mean bringing the angle of the thread of the worm more nearly parallel to the axis of the worm?

A. Yes.

x-Q. 65. In a worm having fifty times the pitch of the worm 76 in Fig. 4, would not one complete turn of the thread advance a distance of about 4–1/6 inches in a direction parallel to the axis of the worm; I mean on the scale of Fig. 4?

A. I do not know. I would have to stop and investigate that.

x-Q. 66. Are you willing to make a drawing or sketch on the scale of Fig. 4 of the patent in suit showing a worm having a pitch fifty times that of the worm 76?

A. I would first have to test it out by trying it on some actual gears.

x-Q. 67. You are unable to lay out such a worm substantially accurately?

A. Yes.

x-Q. 68. You have remarked that if the angle of the thread on the worm 76 were increased, the angle of the teeth on its mating gear 75 would also have to be changed.

A. Yes, it would, if the gears are to work smoothly.

x-Q. 69. If a high speed worm having a pitch 50 times that of the worm 76 were placed on the shaft 78, (as you suggested this morning), then the teeth on the gear 83 would be at a very different angle from the teeth on the gear 75. Is that right?

A. Yes.

x-Q. 70. And in such case, in the sectional view (Fig. 3) more than one tooth should appear in whole or in part on the gear 83. Is that correct?

A. Yes, if the draftsman had attempted anything more than a conventional illustration, and drawn his cross-section accurately. He should have shown probably several teeth in the cross-section of the gear 83. My experience with draftsmen is that they cannot be relied upon to show details of the gearing otherwise than conventional.

Mr. Seward: I move to strike out the last sentence of the answer as volunteered.

x-Q. 71. Don't you think that the fact that the pitch of only one of the worms 76 and 82 is shown in the patent drawings, is an indication to a reader of the patent that the said two worms are alike?

A. No. The reader of the patent is advised of the substantial difference in speed obtained by the two worms 76 and 82, and that the gear 83 rotates much faster than the gear 75. If the two worms were identical, then the only difference in speed would be that due to the difference in diameter of the two sprocket wheels on the two shafts 58 and 78, and hence the gear 83, instead of rotating faster than the gear 75, would rotate about 50% slower. Accordingly, a reader of the patent must assume that there is a sufficient difference between the worms 76 and 82 and the spiral gears rotated by them to produce the desired difference in speed.

x-Q. 72. And even such a skilled man as yourself is unable, without practical experimenting, to lay out the necessary worm. Is that correct?

A. Yes, I should have to go about it with care.

x-Q. 73. In the machines of the patent in suit which you have seen in operation, is it not a fact that the gear corresponding to the gear 75 in the patent drawings was the high speed gear?

A. I did not observe the machines in this respect.

x-Q. 74. Do you understand it to be a characteristic of the patent in suit that the rollers with which the fabric travels in contact on its way to the core from the stock roller should have faces parallel to their axes as distinguished from convex faces?

A. That is what is shown in the patent.

x-Q. 75. Will you state whether or not you understand that to be a characteristic of the apparatus of the patent in suit as you have mentioned other things, in your direct testimony, to be characteristic of the patent in suit?

A. I do not think that any details of the fabric supply of the patent in suit are characteristic beyond furnishing tension upon the fabric as it is drawn onto the slowly rotating core.

x-Q. 76. By the fabric supply, you mean the stock rolls and the tension rolls and connected parts?

A. Yes.

x-Q. 77. Do you understand that the centrifugal force which you have referred to in your direct examination as resulting from the high rotative speed of the core and as having an effect upon the unattached fabric, has any co-operative effect with the tread roller 141 of the machine of the patent in suit?

A. No.

x-Q. 78. You have referred to the spinning rolls 147 as being pressed inwardly by springs or by weights. If the said rolls are pressed inwardly by springs is it a fact that the pressure exerted by the said springs, and hence by the rolls, upon the fabric, becomes less as the said rolls progress from the point of extreme width of the core toward the inner periphery of the core?

A. Yes.

x-Q. 79. Is it a fact that if this pressure is exerted by weights, the said pressure upon the rolls, and hence of the rolls upon the fabric, would remain substantially constant during the travel of the rolls mentioned in the last question?

A. Yes.

x-Q. 80. Is it a fact that the displacement of the cords of the fabric increases from the point which you have referred to as the median zone (shown in your diagram "Fabric Shaped to Core") toward the inner margins of the fabric?

A. Yes.

x-Q. 81. Is it a fact that the centrifugal force, which you have stated in your direct examination, acts upon the

unattached fabric, becomes less and less as the fabric is attached to more and more of the core in inward radial direction?

A. Yes.

x-Q. 82. If the spinning rollers 147 are pressed inwardly by springs, they would exert a different pressure on the fabric on cores of different widths. Is that a fact?

A. Yes.

x-Q. 83. And if weights were used for this purpose, the pressure exerted by the spinning rolls on the fabric would be substantially the same on cores of different widths?

A. Yes.

x-Q. 84. What rotative speed of the core is necessary to produce the centrifugal force having the effect upon the fabric which you state in your direct examination? I mean in the machine of the patent in suit.

A. I have made some tests with the view of determining this, but have not yet reached a definite conclusion. But so far as I have gone, I should say that with a core on which a 34 x 4 inch tire was made there must be a speed of rotation of somewhere in the neighborhood of 50 r.p.m. to make the skirts of the fabric fly outwardly to any appreciable extent.

x-Q. 85. Did you try any experiments with larger cores than 34 x 4?

A. No, I did not try larger cores. Of course, the larger the core the greater the centrifugal force in a given number of revolutions per minute.

x-Q. 86. Do you maintain that in the machine of the patent in suit, when the core is rotated at high speed, there is an actual tendency on the unapplied parts of the fabric to move away from the axis of the core and that this tendency acts against the inward radial movement of the spinning rolls 147?

A. Yes.

x-Q. 87. Do you maintain that in the said machine the

spinning rolls bear upon, with their edges, a portion of the fabric which is unapplied to the core and flying out from the core, for instance, as shown in Figs. 12^b and 12^c of the patent drawings? I mean during the inward radial movement of the spinning rolls.

A. These figures only show approximately the action. My observation is that the rolls press the fabric against the core at the points where they make contact with the fabric and the skirts fly outwardly from the attached portions of the fabric around the rounded edges of the spinning rolls.

x-Q. 88. Then you agree that, in this spinning operation, the operating edges of the spinning rolls press the fabric against the core instead of acting upon a part of the fabric which is not at that time in contact with the core. Is that correct?

A. They really do both. That is to say, at one portion of its rounded edge the roll is pressing the fabric against the core and at another portion the spinning roll is bearing upon a part of the skirt which is extending outwardly away from the core.

x-Q. 89. You mean that one portion of the operating edge of the roll is acting upon the fabric against the core and another portion of the said edge of the roll is operating upon the fabric which stands away from the core.

A. Yes.

x-Q. 90. If the core is rotated at slow speed, say 6 to 12 r.p.m., during the inward radial movement of the spinning rolls, do you say there is any difference in the operation performed by the spinning rolls; I mean any difference between an operation under such circumstances and an operation where the core is rotating at high speed so as to throw the fabric out from its sides, as you have described.

A. Yes.

x-Q. 91. What is the difference?

A. In the first place, at the high speed the spinning roll is obliged to force the fabric down against the core against the outward pull on the fabric, due to the centrifugal force, and this action is not present when the core is rotating at slow speed.

In the second place, when the core is rotating at high speed, the centrifugal force tends to keep the skirts of the fabric smooth and minimizes its attempt to wrinkle or pucker, so that the fabric is laid smoothly upon the core. On the contrary, when the core is rotating slowly, the skirts of the fabric are gathered in wrinkles or puckers and there is danger of these wrinkles appearing in the fabric when laid on the core.

March 27, 1919.

Met pursuant to adjournment.

Cross-examination continued.

x-Q. 92. Would the result insofar as the laying of the fabric down on the core and the arrangement of the threads of the fabric is concerned, be the same in either case, (referred to in x-Q. 90)?

A. I do not feel that I am at present qualified to answer this question. I have not investigated the effects of attempting to form the fabric with the core rotating at slow speed sufficiently to enable me to express a definite opinion with regard thereto.

x-Q. 93. In the disclaimer to the patent in suit reference is made to the ring core being rotatable at a fast speed "whereby the unapplied fabric portion is thrown out from the side of the ring core by centrifugal force". What is your understanding as to the angle at which it is meant the unapplied fabric portion is thrown out by centrifugal force, I mean the angle with respect to the plane of the ring core?

Mr. Rogers objects to the question in so far as it may be construed as calling for an interpretation

or construction of any of the claims in suit, being noted that the language quoted from the disclaimer refers directly to elements of the claims.

Mr. Seward. I refer the Court to Qs. 3 and 4 of the direct with their answers.

A. I do not understand that any particular angle is meant. The angle would depend upon the speed of rotation, the diameter of the core, and will vary in laying down each layer of fabric as the forming or spinning rolls advance inwardly.

Take, for example, the case of the Goodyear machines as commercially operated, the skirts of the fabric are held out stiffly and smoothly and when the action of the spinning rolls begins, the condition of the fabric skirts is approximately that shown in Fig. 12^b of the State patent. As thus held out, the skirts of the fabric are smooth, they extend outwardly, in contact with the curved edge of the spinning rolls, and as the core rotates it brings successive portions of each outflying skirt into contact with a portion of the corresponding spinning roll in advance of the part of the spinning roll which presses the fabric against the core. Accordingly, as the core rotates, the fabric skirt, as it reaches each spinning roll, is folded down against the roll and in opposition to the strain on the skirts of the fabric due to centrifugal force.

The actual angle between the fabric skirts and the plane of the core rotation varies as the spinning rolls move radially inward, but, if the speed of rotation is adequate, the conditions just stated will continue until the work is finished.

x-Q. 94. Will you answer the last question leaving out of consideration the presence or action of the spinning rolls.

A. If the spinning rolls are not used, the condition of the skirts will remain as they are when the high speed is first attained after the fabric has been stretched on the

core. With the speed of rotation used on the commercial Goodyear machines, the skirts of the fabric will then stand out substantially at right angles to the plane of rotation of the core and in a smooth condition.

Mr. Rogers objects to the question as not directed to subject matter comprised within witness's direct testimony and as purely hypothetical, as it involves a mode of operation not contemplated in the commercial operation of the machine.

x-Q. 95. Then is it your understanding of the language I have quoted from the disclaimer that the unapplied fabric is thrown out to a position substantially at right angles to the plane of the core by centrifugal force?

A. I think this would be the case if the centrifugal force was being used to the best advantage. My observation is that the skirts are thrown out at substantially right angles to the plane of the core when a 34 x 4 core is rotating at about 80 r.p.m., but at that speed the skirts are not smooth, but still present waves or corrugations. These waves or corrugations disappear, however, at a higher speed, such as that employed in the Goodyear commercial machines and the centrifugal force is then utilized to good advantage.

x-Q. 96. You mean the thrown-out portions of the fabric will be smooth at a speed of about 120 to 150 r.p.m. Is that correct?

A. They are smooth at that speed and become so somewhere between 80 r.p.m. and 120 r.p.m.

x-Q. 97. You do not know any more accurately than you have just stated at what speed the outflying portions of the fabric become smooth. Is that correct?

A. Yes.

x-Q. 98. Does the cross sectional dimension of the core affect the angle at which the fabric is thrown out for any given speed of rotation?

A. No.

x-Q. 99. At what angle must the unapplied fabric be thrown out by the rotation of the core before it usefully co-operates with the inwardly moving spinning rolls, as you have described? I mean at what angle to the plane of the core.

A. I have not investigated the limitations sufficiently to give a categorical answer to this question. Of course, in a machine where high speed, for example, is a factor, there will be a point at which the benefits of the high speed will begin to disappear. There will be another point in slowing down the speed where none of the advantages of high speed are present. Between these two points there is a range of speed which may be looked upon as a doubtful zone, during which the advantages of the increased speed will more and more show themselves. But to determine at just what speed any particular phenomenon begins to be appreciable, requires a special investigation as to that particular phenomenon before any definite conclusion is reached.

Now, I have not made any such elaborate tests as would enable me to determine the critical points of speed or angle with respect to the various phenomena which counsel may inquire about.

Accordingly, I am not able to give the angle inquired about because I have not investigated it.

x-Q. 100. Can you state it approximately?

A. No, I have made no tests which enable me to state the angle even approximately.

x-Q. 101. Can you state it within 45°?

A. No, I am not going to make any guesses with respect to any specific degree. Such a matter is susceptible of investigation and a determination of the limits. Not being able to foresee all the inquiries which counsel might make, I have not conducted tests which enable me to answer such inquiries.

x-Q. 102. I understand from your last answer that

you do not know within a total range of 45°, at what angle of the thrown-out fabric to the plane of the core the said thrown-out fabric, under the influence of centrifugal force, usefully co-operates with the inwardly moving spinning rolls. Is that correct?

A. Yes.

x-Q. 103. Do you say that the patent in suit shows means for driving the shaft 90, which carries the core, at a speed of 6 r.p.m.

A. As the specification gives as an example 6 r.p.m. for slow speed at two places (p. 2, line 2, and page 6, line 109) I assume that the shaft 58 is to be driven at such a speed that with the gearing ratio shown in Fig. 4 the shaft 70 will be driven fast enough so that the gears 88 and 89 between it and the shaft 90, which are shown in Fig. 5, will drive the core at the speed of 6 r.p.m.

x-Q. 104. A worm and gear mechanism is always used for the purpose of gearing down or slowing down the drive instead of for gearing up, isn't it?

A. No. I am familiar with several very interesting examples which serve for doing just the opposite.

x-Q. 105. Do you mean to say that the gear driven by the worm can be rotated by the worm at a higher speed than the speed of rotation of the worm?

A. Of course, both the gears are worms. If the worm of smaller diameter is the driving worm, the worm of larger diameter might be driven either at the same r.p.m. or even more rapidly to some extent. If the worm gears be used for greatly multiplying the speed, the driven worm would be of smaller diameter than the drive worm.

x-Q. 106. Referring to the patent drawings, would you say that the part 76 and the part 75 are both worms?

A. Yes, they both have spiral teeth.

x-Q. 107. You consider it mechanically correct in the case of a worm and gear drive to refer to either part

as the worm and the other part as the gear, is that correct?

A. Yes, if any generic expression is to be used to cover all instances.

x-Q. 108. I mean, is that correct in the ordinary mechanical parlance?

A. Of course, ordinarily the worm gearing is employed for speed reduction, so that ordinary usage would be such as used in the State patent, which calls the part 76 the worm and the part 75 a spiral gear. But the distinction between the two disappears when the organization is such that one drives the other at an equal or nearly equal speed. In such a case either gear could be called a worm.

x-Q. 109. In the arrangement to which you last referred would the axes of the two gears be at right angles to each other?

A. Yes.

x-Q. 110. Could the gear 75 in the patent drawings drive the worm 76?

A. No.

x-Q. 111. Do you say a worm could be substituted for the worm 76 which would drive a gear of the diameter of the gear 75 at a higher rotative speed than that of the worm?

A. I think so.

x-Q. 112. Isn't there a mechanical limit to the ratio of rotative speed of the driving worm and its driven gear?

A. Yes.

x-Q. 113. What is it?

A. I do not know.

x-Q. 114. Do you say that the driving worm can rotate its driven gear at a rotative speed as great as that of the driving worm?

A. Yes.

x-Q. 115. In so far as the action of the spinning rolls

147 of the machine of the patent in suit is concerned, which action you have described, does it make any difference whether the fabric is stretched on the core by the machine or by hand?

A. So far as the mechanical action of the spinning rolls is concerned, it would have no effect. The product might be materially affected.

x-Q. 116. Do you understand the expression "sheet fabric" in the patent to mean only a woven fabric having warp and weft threads?

A. Yes.

x-Q. 117. How do you know that, in the operation of the defendant's machine which you witnessed on March 18, 1919, the fabric was laid down by the radially moving forming rolls, so that the reticulations of the fabric threads were shaped and disposed as you have described in your direct-examination?

A. I so infer because the effect of the defendant's machine was to lay the fabric smoothly on the core, and because the organization and mode of operation so far as the rapidly rotating ring core and the radially advancing spinning rolls were substantially the same as in the Goodyear commercial machine. I assume therefore the similarity in instrumentalities and in the appearance of the product was due to similar action upon the fabric.

x-Q. 118. In the machine of the patent in suit, the spinning rolls are at a receding angle to the plane of the core throughout their operation. Is that a fact?

A. Yes.

x-Q. 119. Is that true with respect to defendant's machine?

A. As I recall, the exhibition of March 18, 1919 of defendant's machine, the action of the spinning rolls began with them occupying a receding angle to the plane of the core about as indicated in Fig. 14 of the patent

on defendant's machine, namely, the Thropp and DeLaski patent No. 1,119,326. This angle was maintained until the forming or spinning rolls reached the maximum width of the core and began to move inwardly along the decreasing diameter of the core. When this position was reached, the workman moved the plates corresponding to plates 122 of said patent so as to bring the plane of the spinning rolls about perpendicular to the plane of the core rotation, and this condition was maintained during the remainder of the laying down of the skirts of the fabric against the core.

x-Q. 120. Referring to the machine of the patent in suit, do you say that the spinning rolls 147 will form down the unapplied skirts of the fabric, during high speed rotation of the core, as you have described, if the spinning rolls are pressed laterally against the core only by the springs unassisted by any force exerted by the operator?

A. Yes.

x-Q. 121. Do you say it will form the fabric down substantially wrinkle free and in a practical condition?

A. Yes.

x-Q. 122. Would this occur if the core were rotated at 207 r.p.m.?

A. I think so.

x-Q. 123. Have you ever noticed what the forming rollers do when they pass over the splices whereby the ends of the fabric strips are joined, if they are not pressed inwardly by the operator's strength?

A. Yes, they ride over the joints.

x-Q. 124. Do they jump away from the fabric on the core?

A. I have never observed any such jumping away from the fabric.

x-Q. 125. Did you ever carefully observe to see whether they do jump away or not?

A. I have watched them in action and if there has been any jump beyond the slight outward movement due to riding over a double thickness of material, it has been so inappreciable that it has not attracted my attention.

x-Q. 126. Did you ever see the machine of the patent in suit operated, in which operation the spinning rolls were fed radially and shaped on the fabric as you have described, and at which time the operator did not exert some force on the spinning rolls or their support to press them laterally toward the core?

A. On the contrary, I have never seen in any of the Goodyear machines any pressure at all applied at any time by the hands of the operator in pressing the spinning rolls toward the core.

x-Q. 127. You mean pressure applied by the operator directly or indirectly?

A. Either directly or indirectly.

x-Q. 128. Did you ever see a machine exactly like the drawings of the patent in suit?

A. As I have heretofore stated, the commercial Goodyear machines were not identical with the machine shown in the patent in suit. I did not examine the machine at Cincinnati thoroughly as to its mechanical details, and accordingly cannot say how closely that machine follows the detailed mechanical construction shown in the State patent drawings.

As the question refers only to what is shown in the drawings, I would not expect any machine to be identical with the drawings in one identical place, since the specification says that the springs 145 are "shown, diagrammatically, as leaf springs" (page 5, line 111), but states that in practice "strong spiral springs will be used".

x-Q. 129. Now will you say whether you ever saw a machine exactly like the drawings of the patent in suit?

A. I am not able to say whether or not the machine

at Cincinnati is or is not identical with that shown in the drawings of the patent in suit, because I did not scrutinize it closely enough.

x-Q. 130. The other machines which you saw differed from the machine shown in the patent drawings in other respects than with reference to the springs for forcing the spinning rolls laterally, didn't they?

A. Yes.

[RECESS.]

x-Q. 131. I call your attention to x-Q. 111. Would your answer be the same if you should limit the worm to a diameter of only about ½ of that of its driven gear, as shown in Fig. 4 of the drawings?

A. Yes.

x-Q. 132. In such case how many teeth would there be on the driven gear and how many threads on the driving worm?

A. In the stated case of the worm 76 being ½ the diameter of the driven gear 75, and assuming that the gear 75 is to be driven so as to make one rotation to one rotation of the worm 76, and as I recall the conditions of such gears, the teeth on the worm 76 would be at an angle of 30° to the axis and those on the driven gear would be 60° to its axis. The number of teeth would be greater or less depending upon the width of each spiral rib. It is customary in spiral gears to have several widths of teeth on one gear in mesh with several teeth on the driven gear. Accordingly the number of teeth altogether would depend on their fineness.

x-Q. 133. Have the number of teeth anything to do with the ratio of relative speed between the worm and its driven gear?

A. It would not have anything to do with the relative speed, but it might be very material in keeping the two gears in continual mesh with each other.

x-Q. 134. Now I ask you, in the construction you have just described how many teeth there would be or how many threads there would be on the driving worm.

A. That would depend upon the fineness of the teeth. As a rough calculation I should say there would be 25 teeth on the worm 76, assuming the teeth to be of the same width as those shown on Fig. 4.

x-Q. 135. How many on the driven gear 75?

A. About twice that number.

x-Q. 136. Will you make a sketch of that arrangement of worm and gear?

A. I will have one made under my direction.

x-Q. 137. Will you try to bring that tomorrow morning?

A. Yes.

x-Q. 138. Do you say that the machine shown in the patent in suit has the spinning rolls mounted mechanically so as to ensure their radial movement with a gradual advance in proper relation to the fast rotating core?

A. Yes.

x-Q. 139. Does the rotation of the core, in the patent in suit, affect in any way the radial feed of the spinning rolls?

A. No, the radial movement of the spinning rolls is done by the workman turning the feed screw by hand.

x-Q. 140. No matter what the rotative speed of the core may be, the spinning rolls may be fed inwardly by the workman either slowly or rapidly. Is that correct?

A. Yes.

x-Q. 141. The workman could feed them inwardly, during any rotative speed of the core, with a rapid inward motion part of the time and a slow inward motion the rest of the time, couldn't he?

A. Yes.

x-Q. 142. The mechanism which rotates the core has

no effect whatever upon the radial movement of the spinning rolls, in the machine of the patent in suit. Is that correct?

A. Yes.

x-Q. 143. Then what is the means which ensures that the radial movement of the spinning rolls shall be gradual and in proper relation to the fast rotating ring core?

A. The carriage on which the spinning rolls are supported slides upon a guideway, and this guideway is so disposed with respect to the plane of rotation of the core as to ensure that the spinning roll carriage will move radially with respect to the core. The carriage is fed in this radial direction by a feed screw, so that the gradual advance of the carriage is ensured. This gradual advance may not be uniform, since it is dependent upon the hand of the workman, but he soon acquires the necessary skill to enable him to feed uniformly the carriage, and at a speed proper for the rotation of the core.

x-Q. 144. But you agree that there is no means in the machine for ensuring that the spinning rolls shall progress inwardly at any given speed with respect to any rotative speed of the core. That is a fact, isn't it?

A. Yes.

x-Q. 145. It is important, if the machine is to operate practically, that the rolls shall be fed inwardly at a speed having some relation to the rotative speed of the core, is it not?

A. Yes, within limits.

x-Q. 146. If the workman turns the hand wheel on the feed screw too rapidly, the spinning rolls will not lay the fabric down smoothly. Is that a fact?

A. Yes.

x-Q. 147. What do you mean by the "hinge" of the fabric skirts thrown out from the core?

A. The line on which the fabric turns in swinging out.

This line is where the free skirt adjoins the attached portion of the fabric.

x-Q. 148. That is, it is the line at which the fabric ceases to adhere to the core. Is that a fact?

A. Yes.

x-Q. 149. Did you notice that the defendant's machine has means for rotating the core in two directions?

A. I notice that the patent on defendant's machine so describes the drive mechanism of the core, but I did not notice whether the machine itself is so equipped, but assumed it was.

x-Q. 150. Then you did not notice at the demonstration of March 18th, of defendant's machine, whether the core was rotated in one direction while taking the fabric from the supply and in another direction while the spinning rolls were in operation?

A. I did not notice.

x-Q. 151. Did you notice that defendant's machine has means for drawing the fabric onto the core while the core is rotating in either direction?

A. Yes, it was pointed out to me by one of defendant's representatives.

x-Q. 152. The machine of the patent in suit has not this arrangement, has it, or an arrangement for operating in this manner?

A. No.

x-Q. 153. Did you notice in defendant's machine that the fabric supply rolls and tension and guide rolls are mounted vertically above the core?

A. Yes.

x-Q. 154. And that they are adjustable vertically toward and from the core, so that the distance between the last roll engaged by the fabric and the point of application of the leading end of the fabric to the core may be made shorter than is permitted by the construction of the machine of the patent in suit?

A. Yes.

x-Q. 155. Do you consider it a characteristic of the machine of the patent in suit that the inwardly moving spinning rolls shall operate on only a small area of the fabric during any single rotation of the core?

A. Yes.

x-Q. 156. How small?

A. So small that there will be no portion of the fabric so far uncemented to the core as to permit the existence of trapped air.

x-Q. 157. Do you consider it a characteristic of the patent in suit that the circumferential path of the spinning rollers on the fabric shall take the form of a spiral?

A. Yes.

x-Q. 158. How close together must the spirals be?

A. So close that there won't be any trapping of air due to a portion of the fabric being uncemented to the core.

x-Q. 159. Can you give the dimension of the distance between the spirals?

A. In the operation of the machines at the Goodyear factory my estimate is that the spirals are about 1/8 of an inch apart.

x-Q. 160. And is that your understanding of the operation of the machine of the patent in suit?

A. Yes, though doubtless there is some latitude permissible. For example, I noted that in the defendant's machine the spirals, as nearly as I could estimate, were about 1/6 of an inch apart. They might be less than 1/8 of an inch apart, but that would slow down the production.

x-Q. 161. Can you give any more accurate estimate of the distance which the spirals can be apart within the characteristic operation of the machine of the patent in suit?

A. I did have one of the workmen at the Goodyear

factory feed the carriage so fast that the spirals were approximately 3/8 of an inch apart, and it was then evident that the intermediate portions of the fabric were not cemented to the core. I did not determine just what the maximum permissible distance might be.

x-Q. 162. Did you try 1/4 of an inch?

A. No.

x-Q. 163. Do you consider it a characteristic of the machine of the patent in suit that the spinning rolls shall have a narrow operating edge?

A. The spinning rolls should have a rounded edge. I did not measure the thickness of the spinning rolls at the working edge, but I should estimate it at about 1/6 of an inch. They should not be so narrow as to cut or fray the fabric, and should not be so wide as to prevent their ability to press the fabric against the core where it has just been laid down. I could not give any quantitative limit in fractions of an inch.

x-Q. 164. You stated in the direct-examination "The machines which I have seen in use at the Goodyear Tire & Rubber Co.'s factory at Akron, Ohio, so far as relates to the fabric supply, the high and low speeds, the speed changing mechanism, the spinning rolls, and the gradually fed support or carriage for said rolls, are organized and constructed in all substantial respects like the machine illustrated in the State patent in suit, and act in the same way". Do you mean that the tension and guide rolls of the machines in the Goodyear factory, that the gearing for producing the high and low speeds of the core, that the shape and size of the spinning rolls of the said machine, were like those shown in the drawings of the patent in suit?

A. There was a number of differences between the machines in use at the Goodyear factory and the machine specifically illustrated in the patent in suit, and per-

haps it will be a saving of time if I schedule all that I noted, in addition to those specifically inquired about.

Some of the Goodyear machines are duplex machines having two ring cores, and some are single machines having only a single ring core.

The patent shows the machine equipped with four fabric supply rolls, which is true of some of the Goodyear machines, while other machines have six supply rolls.

So far as each supply roll and its tension, take-up and stretching rolls are concerned, I did not notice any difference as compared with the patent.

The Goodyear machines have high and low speed mechanism, and speed changing mechanism, but I did not examine the details of this mechanism so that I can state whether there are any specific differences within the same as compared with what is set forth in the patent, excepting, as I have already stated, that the speed ratio is not as great as that which the State patent gives as an example. I measured the spinning rolls used on the duplex machine, which were 4 inches in diameter, and hence somewhat larger in diameter than those shown in the patent.

The shape of these rolls is substantially that shown in the patent.

On some of the machines the spinning rolls are dish-shaped, and while I did not measure I should estimate them to be somewhat less than 4 inches in diameter.

Some of the machines are used in making clencher tires, and others are used for making tires in which the beads have wires embedded in them, such beads having straight sides. The machines which are used for making the tires with the straight side beads do not have any trimming cutters. The machines which make the clencher tires have trimming cutters which are not mounted on the turret which carries the rolls, but on separate frames.

Both styles of machines have tread rolls correspond-

ing in function with the tread rolls 141 of the patent, but they are not mounted on the turret. Each tread roll is on a separate frame which is under the control of the foot of the workman.

Also neither style of machine has the bead forming rolls shown at 156 and 158 and 159 of the State drawings.

Also each form of machine has a single lever for separating the spinning rolls and holding them apart.

In all the machines each spinning roll is pressed toward the core by a strong spiral spring, as described in the State patent at page 5, line 12; instead of the diagrammatic leaf spring shown in Fig. 9.

x-Q. 165. Did you notice whether or not the tension roll and the guide roll (which is referred to in the patent as a "stretching roll") were convex, as distinguished from cylindrical?

A. I did not. If there was any convexity it was so small that it escaped my observation.

x-Q. 166. In your direct testimony you said, on page 17, "The unattached skirt is forced outwardly by centrifugal force in opposition to the inward pressure of the forming or spinning-roll. The effect is as though the margins of the skirt were being pulled outwardly by invisible fingers against whose pull the spinning rolls must act in forcing the fabric at the hinges against the core." By the word "skirt" did you mean the unapplied margins of the fabric, and by the word "outwardly" did you mean outwardly in a radial direction with respect to the core?

A. I did mean the unattached portions of the fabric by "skirt".

By the fabric being forced outwardly I meant away from the core. The skirts of the fabric do not stand out radially.

x-Q. 167. In what direction, with respect to the core, did you mean to indicate that the force exemplified by "invisible fingers" was being exerted?

A. In a direction away from the core and which sometimes extends perpendicular to the plane of the core and sometimes at an angle to it.

x-Q. 168. When you say sometimes at an angle to the plane of the core I assume that you mean sometimes at less than an angle of 90° to the plane of the core?

A. Yes.

x-Q. 169. In such cases, is the force to which you refer exerted in the direction toward the periphery of the core from a plane at right angles to the plane of the core, the first named plane being located at about the median zone to which you have referred?

A. The centrifugal force is always radially outward. The effect exhibited by the fabric is that sometimes the fabric stands at an acute angle away from the axis of rotation and sometimes at an angle toward the axis of rotation and sometimes substantially parallel with the axis of rotation.

x-Q. 170. Do you mean that the force exerted by the "invisible fingers" is always radially outward or is in a direction parallel with the plane in which the outflying skirts of the fabric are lying?

A. Of course, the "invisible fingers" is a figurative expression, and has reference rather to the direction in which the skirts are standing out, than to the actual direction of the centrifugal force.

Adjourned.

MARCH 28, 1919.

Met pursuant to adjournment.

Cross-examination continued.

x-Q. 171. Do you mean by your last answer that the force which you have mentioned as being exerted, figura-

tively speaking, by "invisible fingers", is exerted in a direction away from the plane of the core and substantially parallel to the plane in which the outflying fabric skirts are at any given moment?

A. Yes. Of course, as I have said before, the centrifugal force which causes the skirts to stand outwardly away from the core is exerted in an outward radial direction. The appearance of the fabric at any moment is such that it looks as though fingers were pulling upon the fabric in the angular direction which the skirts at the time being occupy.

x-Q. 172. Have you made the sketch referred to in x-Q. 136?

A. Yes, I had such a sketch made, and produce it.

This sketch includes three figures. The two upper figures are diagrams giving the outlines of the gears corresponding to the gears 82 and 83 of the State patent, and in as nearly the proportions as the draftsman could get.

The third figure shows both gears in plan view, the gear 82 being shown over the gear 83. I have not had the draftsman attempt to show the spiral formation of the gear teeth, since this would have taken too much time. As shown in this figure, the teeth are shown straight instead of spiral, this being a usual convention in illustrating such gears. As shown in this figure, the teeth on the driving gear 82 are at an angle of 30° to its axis of rotation. The teeth on the driven gear 83 are at an angle of 60° to its axis of rotation.

Such a gearing would be competent to rotate the core at the ratio of speed stated in the State patent.

x-Q. 173. In making this sketch did you consult any other mechanical expert?

A. Yes, I consulted Mr. Frederick Ray.

x-Q. 174. Are the teeth on the two gears intended to be of the same width?

A. Yes, so that they will mesh with each other.

x-Q. 175. How many teeth are intended to be on the gear 82?

A. Twenty-two.

x-Q. 176. And how many on the gear 83?

A. Twenty-two.

x-Q. 177. In answer to x-Qs. 134 and 135 yesterday you stated that the driven gear would have about twice the number of teeth on the driving gear.

A. Yes, I answered too hastily, overlooking for the moment the fact that the angle was twice as great in one instance as in the other.

x-Q. 178. In the arrangement shown on this sketch, what do you say will be the ratio of rotation of the gear 82 to the gear 83?

A. They will rotate at the same speed if the teeth are the same in number. It may be in this sketch which I have that the gear 83 will rotate faster than the gear 82 by reason of the circumstance that the gear 83 is not twice the diameter of 82. In that event the teeth on 83 would be fewer in number than those on 82.

In such case the speed of 83 would be slightly greater than that of 82 in r.p.m.

x-Q. 179. Would you have required actual experiment to lay out the teeth in proper spiral form?

A. I suppose a skilled draftsman would be able to make the proper spiral form without having a gear to follow, but, as I am not a skilled draftsman, I should have to have the actual thing to go by, in order to approximately show the correct spiral form.

x-Q. 180. Could you show it by a single line for each tooth without actual experiment?

A. Not with any accuracy.

x-Q. 181. Do you say that the gear 82 shown in this sketch is properly called a worm?

A. Yes.

x-Q. 182. Is it proper to call a pair of gears "a worm and gear" when they have the same number of teeth?

A. Yes, and it is also proper to call them both worms or both spiral gears or both helical gears or to use one name for one gear and another name for another gear. However the terms may be used, there is no difficulty in understanding what is meant.

x-Q. 183. Is it customary among mechanical men to call such an arrangement a worm and gear?

A. I don't know what the percentage that use it one way or another may be. I think it is common usage.

x-Q. 184. On this sketch do the initials "P. D." refer to the pitch diameter?

A. Yes.

x-Q. 185. And the figures in front of the said letters represent the actual pitch diameters of the corresponding gears on the scale of Fig. 4 of the patent drawings, in inches?

A. Yes.

Mr. Seward: I request my adversary to permit me to offer this sketch in evidence at this time.

No objection.

I offer this sketch in evidence, and request that it be marked "Defendant's Exhibit A, Browne's Sketch of Gearing".

x-Q. 186. What is the speed ratio of the worm 76 to the gear 75 shown in Fig. 4 of the patent drawings?

A. 1 to 45. That is to say, the shaft 58 rotates 45 times as fast as the shaft 70.

x-Q. 187. I refer you to the last sentence of your answer to x-Q. 91. Were you referring to the machine of the patent in suit in that sentence?

A. Yes.

x-Q. 188. Do you consider the operation described in

that sentence to be a characteristic of the machine of the patent in suit?

A. Yes.

x-Q. 189. Referring again to the sketch "Defendant's Exhibit A", do you say that it would be practical to use such a gearing arrangement for transmitting a fairly heavy load in machinery, the understanding being, as before, that the gear 82 is the driving gear?

A. Yes.

x-Q. 190. Do you say that, in the sketch "Defendant's Exhibit A", the gear 82 would be operative to drive the gear 83, if the teeth were straight, as shown?

A. No.

Cross-examination closed.

Redirect-examination waived.

Signature waived.

Whereupon FREDERICK RAY, a witness called on behalf of plaintiff, being duly sworn, deposes and says in answer to interrogatories proposed by Mr. Rogers, as follows:

Q. 1. Please state your name, residence and occupation.

A. Frederick Ray, Short Hills, N. J., Mechanical Engineer and mechanical designer.

Q. 2. Have you designed machinery to any extent?

A. Yes, I have been engaged in designing machinery during practically my whole professional life.

Q. 3. In that work has it ever been necessary for you to design gearing?

A. Yes, very frequently.

Q. 4. Were you present during the cross-examination of Mr. Browne?

A. I was.

Q. 5. Did you hear the extensive cross-examination relating to the particular form of gearing disclosed in the

State patent for the purpose of transmitting fast speed to the ring core?

A. I did.

Q. 6. Referring particularly to x-Qs. 66 and 67 on page 58, will you state whether or not you have been able to lay out the gearing therein referred to?

A. Yes, I have laid out such gearing.

Q. 7. Without going extensively into your calculations, will you state the general result of this laying out?

A. The calculation taking into consideration the speed ratio set forth in the patent results in the speed ratio of the pinion 82 to the gear 83 being almost identically unity. Taking into account the diameters of these two gears as approximately shown in the patent results in the gear drive shown on the sketch "Defendant's Exhibit A". The tooth angle of the pinion in this drive is 30° and of the gear is 60°. These tooth angles and the diameters given on this drawing give this speed ratio of approximately unity.

Q. 8. Is this particular angularity of tooth an unusual one?

A. No, on the contrary it is quite common.

Q. 9. In your experience have you encountered even more acute angularity than this?

A. Yes, I have.

Q. 10. In cases where the worm is the driven member as well as in cases where the worm is the driving member?

A. Yes.

Q. 11. Are you able to produce any specimen of greater angularity than the one referred to by you wherein the worm is the driven member?

A. Yes, I can and produce here the governor and governor shaft of a talking machine motor. On this governor shaft there is a worm having a double thread, and this thread, as near as I am able to measure it, makes an angle with the axis of 68°. In the motor it is driven

by a gear the angle of the teeth on which is 22°. These governors drive very easily, without any difficulty whatever, in fact.

Q. 12. Recurring to the specific lay-out you have already referred to, wherein the respective angles are 60° and 30°, which member would be the driving member and which the driven member?

A. The gear marked 82 is the driving member and the gear marked 83 is the driven member.

Q. 13. Is such an arrangement of gears capable of driving and sustaining a heavy load?

A. Yes, they will carry heavy loads if of proper size, that is, if the teeth are large enough and if they are designed properly for the load.

Direct-examination closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 1. How long have you been practising as a mechanical engineer?

A. I have been engaged as a mechanical engineer and designer since about 1900, that is, since I left college.

x-Q. 2. And you obtained the degree of mechanical engineer about 1900?

A. No I never obtained a bachelor's or what you might call a lower degree. I have received a graduate degree, M. A., 1913 from Columbia University in physics and mathematics.

x-Q. 3. You have had a good deal of experience as a machine designer in a practical and theoretical way both.

A. Yes, most of my work was done in that line.

x-Q. 4. And have you had a great deal of experience in laying our gear drives, both practically and theoretically

A. Yes, I have had a good deal of experience in laying out gears.

x-Q. 5. And this includes worm and gear drives?

A. Yes.

x-Q. 6. Will you produce the lay-out of gearing referred to in Q. 6?

A. I referred to "Defendant's Exhibit A, Browne's Sketch of Gearing".

x-Q. 7. Would this arrangement of gearing shown on the sketch operate if the teeth were straight as shown?

A. No, the teeth are shown in an ordinary manner to indicate that they are spiral gears. No attempt has been made to really show the shape of the teeth, which is very difficult to do.

x-Q. 8. Could you lay out the actual spiral shape of those teeth without actual experiment?

A. Yes.

x-Q. 9. Can you draw single lines on this sketch indicating the spiral of a tooth on each gear?

A. I could do it, but it would require a great deal of work.

x-Q. 10. Is it common, in a worm and gear drive, to have the same number of teeth on the worm and on the gear, in a case in which the worm drives the gear?

A. Yes, that is quite common.

x-Q. 11. Is such an arrangement ordinarily referred to as a worm and gear?

A. Such gearing is more ordinarily called spiral or helical gearing.

x-Q. 12. In the drawings of the patent in suit, the worm 82 is the driving member and the gear 83 the driven member. Is that correct?

A. Yes.

x-Q. 13. You stated that the governor shaft which you produced was driven by a gear having teeth set at an angle of 22°. How many teeth are there on that gear?

A. I do not know exactly. I did not have time to

obtain the whole of the outfit, but I understand there are about 30 teeth.

x-Q. 14. On the governor shaft you produced there are about five complete turns of the worm thread. Is that a fact?

A. No, it is a double thread, so there would be about two and one-half complete turns of each.

x-Q. 15. In a worm and gear drive, would the number of teeth have anything to do with the ratio of relative speed between the worm and its driven gear?

A. Yes, if you consider the number of teeth properly the speed ratio is directly in proportion to the number of teeth. For instance, the small governor shaft which I produced has upon it a spiral gear of two teeth, and the gear which drives it I stated to have approximately 30 teeth. The speed ratio is consequently approximately 15 to 1.

Cross-examination closed.
Deposition closed.

Mr. Rogers introduces in evidence the governor shaft referred to by the witness, marked "Plaintiff's Exhibit No. 6, Ray Governor Shaft".

Signature waived.

Mr. Rogers states that in this action he will ask for a decree only under claims 4, 5, 6, 7, 12, 13, 22, 23, 24, 25, 26, of the State patent in suit, as at present advised.

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Plaintiff,

v.

THE JOHN E. THROPP'S SONS COMPANY,
Defendant.

In Equity,
No. 614.

Defendant's Testimony.

Testimony taken in behalf of the defendant, pursuant to notice and agreement of counsel, before CHARLES J. CAREY, Esq., a Notary Public within and for Summit County, in the State of Ohio; at the plant of The Firestone Tire & Rubber Company, Akron, Summit County, Ohio, beginning on Tuesday, April 29, 1919, at ten o'clock A. M.

APPEARANCES:

ROBERT FLETCHER ROGERS and LUTHER E. MORRISON, Esqs., for plaintiff; also CHAUNCEY L. LANDON, Esq., for plaintiff; and

E. CLARKSON SEWARD, Esq., for the defendant.

WALTER S. KOPLIN, a witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Walter S. Koplin; aged 46 years; Merriman Ave., Akron, Ohio.

Q. 2. Are you now employed by The Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. What work do you do?

A. Repairing green tires.

Q. 4. Have you been an inspector here?

A. Yes.

Q. 5. Did you ever work for The Diamond Rubber Company?

A. Yes, sir.

Q. 6. About when did you start working there?

A. 1903.

Q. 7. What work did you do there?

A. Handbuilt tires for four years, and inspected for seven.

Q. 8. Just tell how you put the fabric on the core when you built tires there by hand.

A. We stretched fabric on by hand, and we made our splice; then we rolled it on top—O, about three inches, I should judge; and we were supposed to stitch it down, but when a man got used to it they would start the core to spinning as fast as it could and the fabric stuck out—why, we let it run that way until we got clear down to the bead. Then, of course, it would bring it down into the groove of the bead and then right over the edge.

Q. 9. After you started the core to spinning and the fabric stuck out, what kind of a tool, if any, did you use?

A. We used the ordinary hand-stitcher.

Q. 10. I hand you a tool, and ask you if that is anything like the hand-stitcher you referred to?

A. Yes, sir; only they wasn't ball-bearing that day. That's the only difference there was.

Mr. Seward: I offer this tool in evidence as Defendant's Exhibit B.

Q. 11. Now, with the core spinning, just explain how you used this hand-stitcher.

A. Why, just hold it up against the core this way, and it would naturally work down to the bead; and then, of course, it would run right around in the groove of the bead and over the edge.

Q. 12. When you said you were holding the stitcher "this way", were you holding it in both hands, near the right side of your chest?

A. Yes, sir.

Q. 13. Did this operation form the edges of the fabric down on the side of the core?

A. Yes, sir.

Q. 14. About how long had you been at the Diamond Company before you began to spin down the fabric in this way?

A. Perhaps a year or a year and a half.

Q. 15. About how often did you do it?

A. That would be hard to tell; a person building tires every day that way, you know, it would be hard to tell how many times a person would do it.

Q. 16. Do you mean that you did it every day?

A. Nearly every day, yes.

Q. 17. Did you see any other men there doing that same thing?

A. Yes, there was lots of them.

Q. 18. At this same period of time?

A. Yes, sir.

Q. 19. You spoke of rolling the fabric on top of the core?

A. Yes, sir.

Q. 20. What kind of a tool did you use for that?

A. It was a roller just like that, only just a trifle larger. Well, the one they use here is larger too.

Q. 21. Do you refer to roller that I have in my hand?

A. Yes. That isn't a regular tire-builder's roller. The kind they used down there is just exactly like that, only a trifle longer.

Q. 22. Is the roller I show you now like the one you say you used in rolling down the fabric at the top?

A. Yes, sir.

Mr. Seward: I offer this last-named roller in evidence as Defendant's Exhibit C.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 23. Is your memory good on dates?

A. Why, pretty fair. The reason I remember that date is because I had a recommend on that date. The one I got from Flynn had no dates on it.

x-Q. 24. How do you know that it was a year and a half after you went into the Diamond employment that you began to spin down tires by hand?

A. It was about that time. Why, a man has to have experience in the business quite a bit before he can do that.

x-Q. 25. You think, then, that it took you a year and a half of experience before you were able to run down tires by hand; is that what you mean?

A. Yes, so as to be a success, so they wouldn't wrinkle.

x-Q. 26. In other words, it required some skill and experience to prevent the fabric from wrinkling?

A. Yes.

x-Q. 27. When was it you became inspector at the Diamond plant?

A. It was about four years after I had been there.

x-Q. 28. That is, in the latter part of 1907?

A. Yes.

x-Q. 29. Did you ever run down tires by hand after you became inspector?

A. Not after I became inspector I didn't. The reason I didn't after I was inspector, I was breaking in new men

about half of the time; I was breaking in new men and inspecting both.

x-Q. 30. When you broke in new men, did you teach them to run down tires in the same way?

A. No.

x-Q. 31. Why not?

A. Because it was against the rules.

x-Q. 32. What were the rules that you followed in breaking in the new men?

A. Why, to stitch the plies down by hand.

x-Q. 33. When you say "to stitch the plies down by hand," do you mean that the ply was stitched down in a path something like as shown in this picture that I hand you?

A. Yes. Yes, a good deal in this form. Of course, you know, after we would break them in, they would naturally break away from the handbuilding, and, as I told you before, spin the tire.

x-Q. 34. You didn't think it was safe to let the new men do it until they had considerable experience?

A. Yes, it was not safe.

Mr. Rogers: Counsel for plaintiff introduces in evidence the sketch referred to in x-Q. 33, and it will be marked as Plaintiff's Exhibit No. 7. He further notes that, for purposes of convenience, he will hereafter refer to this method of hand stitching as the "saw-tooth" method.

x-Q. 35. Did you ever use this hand-spinning method continuously all day at the Diamond plant?

A. No, I couldn't do it only on small tires. The large tires the fabric was too stiff.

x-Q. 36. Did you practise the hand-spinning method all day on small tires?

A. No.

x-Q. 37. You did it only from time to time even on small tires?

A. Yes.

x-Q. 38. Can you tell me what was the weight of the fabric you used on the small tires?

A. No, I couldn't tell you that.

x-Q. 39. It was a lighter fabric, was it, than that you used on the larger tires?

A. O, yes!

x-Q. 40. Are you absolutely certain that you became inspector at the Diamond plant in the latter part of 1907?

A. Yes, sir.

x-Q. 41. Can you fix the date more accurately?

A. No, I don't believe I could. No, I couldn't remember that exact date.

x-Q. 42. Might it have been in 1908?

A. I wouldn't say for sure whether it was or not. It was about four years after I began there.

x-Q. 43. Might it have been in 1909?

A. It was before that.

x-Q. 44. Then the best of your recollection is, that you became inspector at the Diamond plant in 1907 or 1908?

A. Yes, sir.

x-Q. 45. When you spun down tires by the method you have described, were you sitting or standing?

A. Sitting.

x-Q. 46. Were the tires supported on ball-bearings?

A. No, sir.

x-Q. 47. When you held the stitcher in your two hands, in the manner described by you, did you lean your body up against the handle?

A. Yes, sir.

x-Q. 48. Was this the general practice?

A. Yes, sir.

x-Q. 49. Do you think you pressed the stitcher against the tire with as much force as the stitcher is now pressed against the tire, say, in machines like those in the Firestone plant here?

A. Why, I couldn't—it would be pretty hard for me to say that; I never worked on the machines; I never worked on one of the building machines; I wouldn't know how hard they do bear down.

x-Q. 50. You have seen the weights on the Firestone machine, haven't you?

A. Yes, sir.

x-Q. 51. How much weight do you estimate is used in these Firestone machines for holding the stitcher or forming-roll against the tire on the core?

A. I should say there isn't any more than a man could use.

x-Q. 52. And how much is that?

A. Well, I don't know. Just what a person could bear his weight against there, and his strength too—bears right up against there—the tire.

x-Q. 53. You say, though, you were sitting down when you spun the tires by hand?

A. Yes, sir.

x-Q. 54. Could you apply your weight when you were sitting down?

A. Yes, sir.

x-Q. 55. Was not your weight supported by chair or stool you sat on?

A. No, a person would put their foot back and generally brace themselves.

x-Q. 56. Well, would you call that pressure given by weight or muscular pressure of the operator?

A. I don't know what you would call it.

x-Q. 57. Referring again to my x-Q. 51, are you able to estimate the amount of weight that is used in the Fire-

stone machine for holding the stitcher or forming-roll against the tire on the core?

A. O, I should judge it would be about 30 or 40 lbs. I know a handmade tire is harder to repair as a green tire than a machine-made tire.

x-Q. 58. Why is a green or handmade tire harder to repair than a machine-made tire?

A. The plies are benzined just slightly before the other ply is put on.

x-Q. 59. And that is what makes the fabric stick more tightly?

A. I think it is, yes.

Cross-examination closed.

Deposition closed.

Signature waived.

CHARLES R. DRACH, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Charles R. Drach; aged 37 years; Akron, Ohio.

Q. 2. You are working now for The Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. What work are you doing now?

A. Why, I am doing everything in the Tire Room to be done, anything.

Q. 4. Did you ever work for The Diamond Rubber Company?

A. Yes, sir.

Q. 5. When did you first go there?

A. First went in 1905; I worked about three months; then I quit; went back in 1906 and worked about four years and eight months.

Q. 6. When you went to the Diamond in 1906 what work did you do there?

A. Built tires by hand.

Q. 7. Please describe how you built the tires; I mean how you put the fabric on the core.

A. Well, we first cemented the core, and started the ply on top of the iron core, and pulled it around; then we took and spun the core real fast, and held stitcher against it, right down to the bead line.

Q. 8. When you speak of a stitcher, was it a tool anything like Defendant's Exhibit B?

A. Yes, same thing, same thing; only the handle was straight; there was no bump in it.

Q. 9. When you spun the core real fast, what position were the edges of the fabric in?

A. Right out, right out straight.

Q. 10. Did you have any name you called that fabric standing out?

A. Why, when I first went there, they always told me saucer fashion, sticking right out.

Q. 11. How did you hold the stitcher when the tire was spinning?

A. I held it right on the side, and run it right down to the bead line.

Q. 12. Did you hold it in both hands?

A. Both hands.

Q. 13. Was it against your body, or away from your body?

A. It was away from my body.

Q. 14. How soon after you went to the Diamond Company in 1906 did you do this spinning down of the fabric?

A. Right away, when the rest of them was doing it, I started, right away.

Q. 15. Did you see other men there doing that same thing at the same time?

A. They all done it, the gang I was in, twelve men.

Q. 16. When you say you held the stitcher on the side, do you mean on the side of the core?

A. On the side of the core.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 17. When was it in 1906 you went back to the Diamond Company?

A. In June, about the second week in June. I don't remember the date.

x-Q. 18. And you say you began the hand-spinning method of making tires almost at once?

A. As soon as I started back to work in there they was all doing it.

x-Q. 19. Did your inspector or foreman tell you to make tires in this way, by the hand-spinning method?

A. He never told me which way, nor never stopped me from it.

x-Q. 20. Who was your inspector?

A. Why, George Whalen was one, and Arthur Harvey.

x-Q. 21. When you went to the Diamond Company, did they teach you any method of making tires by hand?

A. Never taught me to make tires.

x-Q. 22. You mean to say you just picked it up yourself?

A. Yes.

x-Q. 23. Was this hand-spinning method you have described the only method you employed in making tires in the Diamond plant?

A. Why, as far as I see, every gang does all the same.

x-Q. 24. You never saw any other method of making tires in the Diamond plant except by this hand-spinning method?

A. Never seen any.

x-Q. 25. In other words, that was the only method you ever saw in the Diamond plant, of making tires by hand?

A. That's the only method I see.

x-Q. 26. And you used that method all day long, and never stitched down a ply of fabric on a core in any other way?

A. The last ply over the bead was spun down with the stitcher, and under the bead was stitched down; then we give it a spin, and held stitcher in there, and heaved it down to the bead line as far as it would go.

x-Q. 27. What did you do the first four months you came to the Diamond Company?

A. Build tires.

x-Q. 28. And how did you build them then?

A. Same way.

x-Q. 29. By the hand-spinning operation?

A. Hand-spinning operation.

x-Q. 30. Then you never built tires any other way all the time you worked for the Diamond Company?

A. I never built tires any other way, even during that first four months.

x-Q. 31. Then, so far as you know, the hand-spinning method was the only method ever employed by the Diamond Company in making tires by hand?

A. At that time.

x-Q. 32. At what time?

A. Well, about the time I was ready to leave the employment, they changed. The tires wasn't coming what they should be. They had a new system there then, changed the system; and I left for outside work.

x-Q. 33. What was the new system they introduced at that time?

A. Well, they claim that they formed air pockets.

x-Q. 34. You mean by the hand-spinning method?

A. By the stitcher pressing the stock made it more tight, more expand to it.

x-Q. 35. What do you mean by the stitching method?

A. Well, it drawed the stock to the core more by spinning it than it did by stitching it.

x-Q. 36. When was this?

A. Well, the second time when I was with the Diamond Company.

x-Q. 37. Had you ever seen this stitching method used in the making of tires?

A. On a new man, may be he couldn't spin the core and stitch it down. Sometimes I have seen it.

x-Q. 38. Then, as a matter of fact, you were aware of another method being used for the making of tires by hand at the Diamond plant, other than by the hand-spinning method?

A. I was never told any other way. I was aware of such a method.

x-Q. 39. But you were taught to do it by the hand-spinning method; is that correct?

A. Correct.

x-Q. 40. Who taught you?

A. The inspector.

x-Q. 41. Please tell me the name of the inspector that taught you.

A. George Whalen.

x-Q. 42. And when was this?

A. 1906.

x-Q. 43. He taught you this in 1906?

A. Yes, sir.

x-Q. 44. How did you make tires during your previous employment by the Diamond Company, in 1905?

A. Well, made them the same way, only didn't make quite so many. I made them by spinning.

x-Q. 45. When was it you say the change occurred from stitching to spinning?

A. About two months before I left the Diamond Rubber Company the last time they wouldn't let them spin the tires.

x-Q. 46. When was that?

A. In 1910.

x-Q. 47. And what was the difficulty that induced them to change from the hand-spinning method in that time, in 1910?

A. Well, the stock was narrow at times, and they couldn't form the bead line; had to be a bead line to put the beads on; beads put on by hand.

x-Q. 48. They couldn't get the stock down to the bead line by the hand-spinning method?

A. They couldn't by stitching; by spinning we got it.

x-Q. 49. What method did they change to in 1910?

A. They cut the stock wider, and made them hand-stitched.

x-Q. 50. What do you mean by "hand-stitched"?

A. Hand stitch is to hold the fabric in one hand and stitch with stitcher in the other hand.

x-Q. 51. I call your attention to Plaintiff's Exhibit No. 7, and ask you if that represents substantially the path of the stitcher in the operation to which you have referred in your last answer?

A. Yes, sir.

x-Q. 52. Then I understand your testimony to be that in 1910 the Diamond Company changed from the hand-spinning method to the stitching method, as indicated in this Plaintiff's Exhibit No. 7?

A. Over the bead.

x-Q. 53. What was the reason they gave for changing from the hand-spinning method to this other stitching method, in 1910?

A. Well, the stock—the stock was narrow; they changed and made it wider, and had to stretch it more.

x-Q. 54. And, to get this greater stretching, they used the stitching method shown in this Plaintiff's Exhibit No. 7?

A. Yes, at the top of the bead they done that.

x-Q. 55. And you understood that you could get more stretching with this stitching method shown in Plaintiff's Exhibit 7 than you could in the hand-spinning method? I mean that's what they told you?

A. Yes.

Cross-examination closed.

REDIRECT-EXAMINATION, BY MR. SEWARD:

Rd-Q. 56. What was your own experience? Could you get more stretch by spinning or stitching?

A. More stretch with spinning.

Rd-Q. 57. Do you mean to say that the inspector, George Whalen, taught you how to do this hand spinning, or that you picked it up yourself?

A. My inspector showed me.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. ROGERS:

Rx-Q. 58. You say that, in your personal experience, you could get more stretch by spinning than by stitching?

A. I could, yes.

Rx-Q. 59. But that was not the case with all of the other tire-makers in the Diamond Company?

A. Everybody that was spinning that I see. They must have: I didn't see them stitch any.

Rx-Q. 60. How do you know you could get more stretch by spinning than by stitching?

A. By the work.

Rx-Q. 61. You mean by the work you did on tires that you made by spinning as compared with the tires you made by stitching?

A. Yes.

Rx-Q. 62. How many tires do you think you made by stitching?

A. About three a day.

Rx-Q. 63. Did you pick up the stitching method, or were you taught the stitching method by some one?

A. I picked it up.

Rx-Q. 64. You say you were continuously in the employ of the Diamond Company from 1906 until 1910, or thereabouts?

A. Thereabouts, yes.

Rx-Q. 65. What other tire-making concerns have you ever been connected with here in Akron?

A. In Akron? I worked for the Goodyear about two months.

Rx-Q. 66. When was it you worked for the Goodyear Company, Mr. Drach?

A. Some time in 1914 and 1915.

Rx-Q. 67. What department did you work in at the Goodyear plant?

A. Tire-building Department.

Rx-Q. 68. Do you remember the number of the department?

A. I don't remember it.

Rx-Q. 69. And that was the only time you were ever employed by the Goodyear Company?

A. That was the only time.

Rx-Q. 70. Quite sure of that, are you, Mr. Drach?

A. Yes, sir.

Recross-examination closed.

RE-REDIRECT-EXAMINATION BY MR. SEWARD:

R-rd. Q. 71. What is your middle name?

A. Raymond.

Re-redirect-examination closed.

Deposition closed.

Signature waived.

CARY D. DERRY, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Cary D. Derry; aged 44 years; Kent, Ohio, R. F. D. No. 9, Box 35.

Q. 2. You are employed now by The Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. What work do you do here?

A. Inspecting tires.

Q. 4. Did you ever work for The Diamond Rubber Company?

A. Yes, sir.

Q. 5. When did you first go there?

A. Forepart of 1904.

Q. 6. What work did you do there in 1904?

A. Handbuilt tires.

Q. 7. Please describe how you put the fabric on the core in building those tires by hand.

A. Well, we pull the fabric on by hand. The core is cemented all over. We pulled it around by hand. And to stitch the fabric down you were supposed to stitch it by stroke. Practically all of them did.

Q. 8. Did you put the fabric down on the side of the core in any other way than by stitching by stroke?

A. Yes, spun the core, and used the stitcher.

Q. 9. Was the stitcher you used anything like Defendant's Exhibit B?

A. Practically the same kind of a stitcher.

Q. 10. When you spun the core, what position did the edges of the fabric take?

A. Kind of an upward course, flared out.

Q. 11. How fast did you spin the core?

A. Fast as we could.

Q. 12. Just describe how you used the stitcher when you spun the core.

A. Well, spin the core, get it going as fast as you could; take your stitcher and hold it just about that angle, as near as I can tell you; be about forty-five degrees, wouldn't it?

Q. 13. Did you hold it in one hand or two?

A. Two hands.

Q. 14. Did you hold your hands against your body, or away from your body?

A. Both ways. Spin it down on one side, hold it like this; spin it on the other side, one side would be open, and the other side you have your body against it. That would save you time from walking clear around your tire. While spinning down one side, I would hold it against my body; and while spinning it on the other side, I wouldn't.

Q. 15. Did you see any other men at this time at the Diamond plant spinning down the fabric as you have described?

A. Yes, sir.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 16. Exactly when was it that you went into the employ of the Diamond Company?

A. 1904. Early part of 1904. I can't give you the exact date.

x-Q. 17. And how long did you remain with the Diamond Company?

A. Practically three years.

x-Q. 18. And then where did you go?

A. Went from the Diamond to the street-car line about nine months.

x-Q. 19. And then where?

A. Went from there over to the Goodyear.

x-Q. 20. When was it you were with the Goodyear Company?

A. Nine months after that I was with the Goodyear. I can't give you no dates on that. I thought I had them at home, but I haven't. The time I was at the Goodyear is the time they installed that new machine. I saw the first tire put up on that new machine.

x-Q. 21. What new machine do you mean, Mr. Derry? Do you mean the State machine?

A. The first commercial machine they had. That's all I know about it.

x-Q. 22. Do you remember how long you were with the Goodyear Company at that time?

A. About nine months, as near as I can tell you.

x-Q. 23. When was it you went to the Diamond Company?

A. About 1904.

x-Q. 24. But you don't remember the year you were in the employ of the Goodyear Company?

A. No, I don't; not the exact date.

x-Q. 25. How long were you with the Diamond Company?

A. Practically three years.

x-Q. 26. It might have been over three years?

A. No, it wasn't over three years.

x-Q. 27. You think you were nine months with the Goodyear Company?

A. Yes, thereabouts.

x-Q. 28. What other occupations have you followed?

A. Well, rubber business, street-car line. I was in shoe business practically two years, when I was in business for myself.

x-Q. 29. You were a dry-cleaner, were you not?

A. Yes.

x-Q. 30. Can you give me dates of these various occupations by you?

A. No, sir.

x-Q. 31. Your memory is not very good on dates?

A. Not very good.

x-Q. 32. When you first went with the Diamond Company, did you go at making tires immediately?

A. Yes, hand building.

x-Q. 33. What method were you taught when you went to the Diamond Company?

A. You was taught to pull your plies on, stitch them down with a stroke.

x-Q. 34. You mean somewhat after the fashion indicated in Plaintiff's Exhibit No. 7?

A. Yes, that's all right. Yes, sir, that's what we call the stroke.

x-Q. 35. That was the method you were taught?

A. Yes, sir.

x-Q. 36. Did you have any difficulty in spinning the core on the stands that were in use at the Diamond plant?

A. Only difficulty ever I had was to keep away from the boss on it.

x-Q. 37. In other words, that spinning method of making tires was not approved by the inspector, the authorities at the Diamond?

A. No.

x-Q. 38. And for that reason you were taught the saw tooth method?

A. Yes, sir.

x-Q. 39. How long after you went to the Diamond Company did you begin to make tires by this spinning operation?

A. O, I suppose practically after the first three months I was there.

x-Q. 40. Might have been longer than that, might it not?

A. Might have. As near as I could tell you.

x-Q. 41. You can't approximate the date any closer than that?

A. No.

x-Q.42. What kind of core-stands were in use at the Diamond Company?

A. Forked, solid stands; I mean a solid fork, upright, swiveled on the base.

x-Q. 43. Was the core supported on ball bearings?

A. No, sir.

x-Q. 44. Do you know what kind of bearings the core turned on?

A. Didn't have any bearings; had a spider.

x-Q. 45. Was the spider supported on ball bearing?

A. No, sir.

x-Q. 46. Do you know what kind of a bearing the spider has?

A. Nothing but just a common pin, iron pin about that big around, inch and a half or inch and a quarter in diameter.

x-Q. 47. You say you spun the core as high a velocity as you could?

A. Yes, sir.

x-Q. 48. Why did you want to give it so high a velocity?

A. To make your number a good deal easier, to get the speed to pull the fabric down. Run it on low speed, wouldn't flare out: on high speed, it would flare out.

x-Q. 49. Why did you want it to flare out?

A. So the fabric wouldn't wrinkle.

x-Q. 50. In other words, it was your experience that, when the core was rotating at high velocity so as to make the fabric flare out, this operation resulted in prevention of wrinkles?

A. Yes, sir.

x-Q. 51. If you rotated the core at a less velocity, so

that the fabric would not fan out or flare out, were you apt to get wrinkles?

A. The stitcher wouldn't take a hold. If the fabric wouldn't flare out, the stitcher wouldn't take hold. As fast as the core would go the fabric would flare out and give the stitcher a chance to take hold.

x-Q. 52. In other words, the stitcher took hold better and was offered more resistance when the fabric was thrown or flared out than when the fabric was simply lying down flat along the side of the core; is that what you mean?

A. Yes, sir.

x-Q. 53. When you gave the core the highest velocity you could, did the speed die down toward the close of the operation?

A. Yes, sir.

x-Q. 54. Was it ever necessary to spin the core a second time because of its tendency to stop before the spinning operation was completed?

A. Yes. Run it down on one side, and had to give it a second whirl.

x-Q. 55. What I mean is this: There was a tendency, you say, for the rotating core to slow down?

A. Yes, sir.

x-Q. 56. Was it ever necessary to give the core an additional impulse, so as to enable you to complete the spinning operation on one side?

A. Yes.

x-Q. 57. Have you any idea of the amount of pressure that you exerted in holding the stitcher or forming-roll against the side of the tire?

A. That would be hard to judge.

x-Q. 58. I understand that, when you were spinning one side——

A. I should judge in the neighborhood of 25 or 30 lbs., along there, as near as I can tell you.

x-Q. 59. I understand you to say that on one side of the tire you pressed your body against the stitcher?

A. Yes, sir.

x-Q. 60. And on the other side you simply held it in your hands without pressing your body against it? Do you think that would result in a difference of pressure on the two sides of the tire?

A. I don't think there would be very much of a variation.

x-Q. 61. I understand you used this hand-spinning method only when the boss wasn't looking?

A. Yes, sir.

x-Q. 62. What would have happened if he had seen you doing it?

A. A bawling out, I suppose.

x-Q. 63. Did you use this hand-spinning operation on all sizes of tires?

A. No, sir. I used it only on three-inch tires.

x-Q. 64. Have you any idea of the weight of the fabric that you used on these three-inch tires?

A. About an eight-ounce duck, if I ain't mistaken.

x-Q. 65. Why didn't you use the spinning operation on the larger-size tires also?

A. It wouldn't work as well.

x-Q. 66. Why not?

A. Too much fabric. The wider the plies, the harder they are to pull on by hand. We didn't have any machines in those days.

x-Q. 67. Did they use the same weight fabric on the larger tires as on the small ones?

A. Yes, sir.

x-Q. 68. In other words, they used eight-ounce duck, or thereabouts, on all sizes of tires?

A. Yes, sir.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. SEWARD:

Rd-Q. 69. When you speak of pulling the fabric on by hand, do you mean the operation of stretching it on the core?

A. Yes, sir.

Rd-Q. 70. When you were at the Goodyear plant, did you ever spin down any fabric as you have described?

A. No, I wouldn't say as I did. There wasn't enough of it to amount to anything. There was a little of it done, but I wouldn't say so.

Rd-Q. 71. Did you see anybody at the Goodyear plant do that?

A. Yes.

Rd-Q. 72. Was it done on the sly?

A. Yes, sir.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. ROGERS:

Rx-Q. 73. Can you tell me who did this hand spinning in the Goodyear plant?

A. No, I can't. Practically all new men at that time, coming and going.

Rx-Q. 74. Where did you see it done in the Goodyear plant?

A. Hand-building Room.

Rx-Q. 75. Well, you didn't do it, evidently, at the Goodyear plant yourself?

A. No, I wouldn't say that I did.

Rx-Q. 76. Can you tell me the name of the foreman you worked under at the Goodyear plant, in the Hand-building Room?

A. Yes, sir, Al Huguelet.

Rx-Q. 77. Mr. Huguelet is dead, is he not?

A. Yes.

Recross-examination closed.

Deposition closed.

Signature waived.

Recessed until two o'clock P. M. of the same day.

Resumed, after recess. Present: as before.

WILLIAM HELLER, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. William Heller; aged 52 years; Akron, Ohio.

Q. 2. You are employed here by the Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. And are you an inspector of tire carcasses?

A. Yes.

Q. 4. How long have you been here, Mr. Heller?

A. I was here about a year or year and a half when they first started up building those tires. Then I lost my wife, and I was off from long about October till January 1st, and came back January 1, 1907.

Q. 5. You have been here since 1907?

A. Yes.

Q. 6. Did you ever work with The Diamond Rubber Company?

A. Yes, sir.

Q. 7. When did you work there?

A. Well, started on 1901.

Q. 8. And stayed there how long?

A. About four years.

Q. 9. What did you do at the Diamond Plant?

A. Well, when they first started, I was working by the day, most anything. And after they got ready to build, I started building.

Q. 10. Do you mean building tires?

A. Building tires.

Q. 11. About when did you start building tires at the Diamond?

A. Well, according to my book, the size of the tires, May 20, 1902.

Q. 12. Just describe how you put the fabric on the core in 1902.

A. What do you mean—the pulling on of it?

Q. 13. The pulling on, and the rest of the work.

A. At that time, why, we pulled it on in first place on wooden core, and then we experimented getting it down most any ways; used to pull it down with pliers, wire pliers, nail it fast with tacks, tacked it down; worked it down, stitched it down, worked the core; then we used to have a paddle there; we used to chop it down; that's what the boys used to call it them days—chop it down.

Q. 14. Did you make tires on the iron cores at the Diamond plant?

A. Yes, sir.

Q. 15. About when did you start making them on iron cores?

A. Well, that was about two years later, as near as I can remember.

Q. 16. That's about 1904?

A. Somewhere along about there.

Q. 17. When you made them on the iron cores in 1904, describe how you put the fabric on.

A. We cemented the cores, pulled it on by hand, then stitched it on with the stitcher.

Q. 18. Did you ever follow any method in which the core was spun or rotated by you?

A. No, no more than spin it a certain way one way, get up to it; one way so as to get at it in the right way, turn the core in this way to get at it this way.

Q. 19. Just describe to us just how you put the fabric on when you spun the core. Tell us just what you did.

A. I pulled the fabric on in the ply. Always cut in plies. And then, after the plies were on the tire, splices made, either stitch it down by hand or whirl the core, hold the stitcher against the core and spin it right down.

Q. 20. How fast did you whirl the core?

A. O, just as fast as we could. That depends on the size of the core. Heavier the core, the faster it spun.

Q. 21. When the core was spinning fast, what position did the edges of the fabric take?

A. Straight out.

Q. 22. When you speak of spinning it down with a stitcher, do you refer to a tool anything like Defendant's Exhibit B?

A. Yes.

Q. 23. Did you at that time make any special stitcher of your own?

A. Yes, sir.

Q. 24. How did that differ from this stitcher Defendant's Exhibit B?

A. It is similar to that stitcher, only the wheel was larger, worked down a ply smoother than a small stitcher. If I spin the core, it wouldn't wrinkle the fabric. Would run over it lots easier than those we used to have.

Q. 25. What was the diameter of the roller in this stitcher you had made for yourself?

A. 3½ inches.

Q. 26. Why did you have that large stitcher made?

A. So I could get the work out quicker, get it down easier and quicker.

Q. 27. How did you hold the stitcher when you were spinning down the fabric?

A. I held it with both hands.

Q. 28. Did you hold your hands against your body or away from your body?

A. Against the body, against the shoulder.

Q. 29. At that time did you see any other men spinning down the fabric as you have described?

A. Yes, sir.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 30. How do you fix the date when you began to work for the Diamond Company?

A. How do I fix the date? Why, I got it marked down in my book here, when I put down my time, in the evenings.

x-Q. 31. When did you begin to keep that book?

A. Well, I have always kept a book of my time since I started working. I keep my time during the day. What I do that day I generally keep. I have got a half a dozen of those books. Piece-work, make certain number of pieces, why, you don't want to miss any of the pieces.

x-Q. 32. Will you show me the entry in the book to which you refer?

A. What? The date of starting at the Diamond? Why, yes. May the 19th; that was the last day work I done. Then I started on May the 20th on piece-work, on tires. (Witness shows book to cross-examining counsel.)

x-Q. 33. This was in the year 1902, was it?

A. Yes.

x-Q. 34. What was the piece-work you started on on May 20, 1902?

A. What were the tires, you mean?

x-Q. 35. What was the kind of piece-work; what was it?

A. Building tires.

x-Q. 36. Were you building these tires at that time by the hand-spinning method?

A. Well, no, I don't know as I was just spinning them at that time. Just experimenting, you know. But later on when they got to them, commenced; worked it out.

x-Q. 37. How were you making tires at that time?

A. At that time we were building them on wooden core. Pulled them down with pliers. One man get on one side—generally on a table like this; one man get on one

side and other on the other and pull them down with pliers, tack them down, under the bead.

x-Q. 38. Did you ever stitch tires down in the Diamond plant?

A. Yes.

x-Q. 39. Tell me briefly how you performed this stitching operation.

A. Well, we worked the stitcher with one hand, pulled on the ply with the other. Stitched it right down, with right arm to the core; stitched it right down.

x-Q. 40. In other words, you worked the stitcher over the tire along a path something like that I show you in Plaintiff's Exhibit 7?

A. Yes, similar to that.

x-Q. 41. Did you ever use that stitching method in connection with wooden cores?

A. Yes, sir.

x-Q. 42. And later on in connection with iron cores also?

A. Yes, sir.

x-Q. 43. You made all sizes of tires?

A. Yes, sir.

x-Q. 44. With that stitching method, did you not?

A. Yes, sir.

x-Q. 45. Did you make all sizes of tires also with the spinning method?

A. No. Well, up to four inch, five, five and a half, why, it was too hard to spin the core and stitch it down, too much stock there for a man with his hands.

x-Q. 46. In other words, you found the hand-stitching method more difficult to perform in connection with the larger-size tires because there was a greater amount of fabric to shape down on to the core; is that correct?

A. Yes.

x-Q. 47. You understand, of course, that I am now talking about the hand-spinning method?

A. Yes, sir.

x-Q. 48. How did you make the larger-size tires that you have referred to?

A. Well, made them in different ways. I stitched them down that style (referring to Plaintiff's Exhibit 7); then, where I had good pliable stock, stitched them a part way, then spin them; done that a good many times.

x-Q. 49. You mean that, after you had stitched down part way on the side of the core, then you would spin down the bead portion?

A. Yes, sir.

x-Q. 50. Were you ever employed by the Goodyear Company, of this city?

A. Yes, sir.

x-Q. 51. When was that?

A. I was there about four weeks, five, four or four and a half weeks, along 1902. Not on tire work, though.

x-Q. 52. When was it that you were absent for some months from the Firestone Company after your original employment, at the time that your wife died?

A. August, 1st day of August, 1907.

x-Q. 53. And then you were away how long?

A. O, I was away before that. I was away taking care of her. She was sick in the hospital. I took care of her to home as long as I could.

x-Q. 54. Can you tell me how long you were away altogether?

A. O, I was away some six or seven months, along there; I can't just state to the day.

x-Q. 55. And you came back when?

A. January 1st I came back, 1907.

x-Q. 56. And this was after your wife's death that you came back to the Firestone Company?

A. January 1, 1907, I came back to the factory, and my wife died the August before that.

x-Q. 57. Then when you said your wife died in August, 1907, you made a mistake, did you?

A. Yes. She died in August, and I came back on the 1st of January, 1907.

x-Q. 58. Were you continuously in the employ of the Diamond Company after you first went to it in 1901 for some time?

A. No, no. I kept changing around quite a bit there. Those rubber shops at that time didn't work steady; maybe a day's work, maybe an hour's work; didn't work steady. Had to go and pick up something wherever you could.

x-Q. 59. You say your employment with the Goodyear Company was in 1904; that correct?

A. 1902.

x-Q. 60. And that was the only time you were employed by the Goodyear Company?

A. Yes.

x-Q. 61. You are absolutely certain that it was in 1902 that you were employed by the Goodyear Company?

A. Yes.

x-Q. 62. What time in 1902 was it?

A. Along April, May.

x-Q. 63. Might it have been June, 1902?

A. No, wasn't in June. No later than May.

x-Q. 64. And after that employment by the Goodyear Company where did you go then?

A. Back to the Diamond.

x-Q. 65. The book that you just showed me covers the period that you mentioned as that when you were employed by the Goodyear Company?

A. Yes.

x-Q. 66. Will you kindly show me the entry in that book that refers to Goodyear employment at that time, in April or May, 1902?

A. April, up to the 8th day of May. From the 3rd day of April to the 8th day of May. (Witness shows book to cross-examining counsel.)

x-Q. 67. You are absolutely certain that those entries refer to the year 1902, are you?

A. Yes, I am.

x-Q. 68. The reason I am asking you about the date of your Goodyear employment is because I want to compare it with the showing of the Goodyear books; and therefore I want you to be positive it was the year 1902, if that be the fact.

A. Well, sir, I am just as positive of that as I can be. There is the date. Of course, I am not a bookkeeper; I don't keep the dates down as a regular bookkeeper does. As near as I can recollect, it will bring it to just about to that.

x-Q. 69. When did you first use ball-bearings in the spider in the core stand at the Diamond plant?

A. Ball-bearings in the spider? Never had them when I was there.

x-Q. 70. Are you able to state how great a pressure, estimated in pounds, you applied to the stitcher when you held it up against the sides of the core in the hand-spinning method?

A. O, I couldn't give no pressure in pounds. I generally leaned the body against it hard as I could.

x-Q. 71. You couldn't tell within, say, 10 lbs. how much pressure you put on the stitcher?

A. No, I couldn't. Never thought of that.

x-Q. 72. Are you able to say whether or not the pressure was uniform on both sides of the core?

A. Well, just about.

x-Q. 73. How are you able to say that if you are unable to tell within 10 lbs. how much pressure you put on?

A. Well, we generally sat on a stool the same height on one side as the other, always held the stitcher in the same position, and the weight of a man's body would be about uniform.

x-Q. 74. Are you able to say whether or not the

amount of pressure you applied in the hand-spinning operation was greater than or less than the amount of pressure that is now put on the arm by the weight in the present form of Firestone tire machine?

A. O, this weight, the way they put it on here with this lever, is greater than a man could put on with his hand.

x-Q. 75. Much greater?

A. O, considerable! Considerably greater. I don't know how much pressure they are getting on here. I wouldn't know what pressure a man was getting on in pounds. The pressure is not even on those machines here. Take dry stock, it takes a greater pressure to pull it down, and they bear on it heavier than they do on soft, pliable stock.

x-Q. 76. Did you make the same allowance for dry stock and for soft, pliable stock in the pressure you used in the hand-spinning operation?

A. No.

x-Q. 77. In other words, you always tried in the hand-spinning operation, to press the stitcher against the core with the same amount of force, no matter what was the nature of the fabric it was acting on; is that correct?

A. No. We just pressed on it heavy enough so as to work the plies down smoothly.

x-Q. 78. When you were holding the stitcher up against the tire, was there any tendency for the stitcher to jump away from the core when it encountered a splice? I mean, of course, in the hand-spinning operation?

A. Yes; that's why I generally used both hands to hold the stitcher and let it rest against the shoulder, so as to hold it steady.

x-Q. 79. When this happened, did you always succeed in getting the stitcher back to the exact same line that it was following before it struck the splice?

A. Generally go back up to the top and down over again.

x-Q. 80. In other words, it was difficult to hold the stitcher in proper relation to the core; and, when you struck a splice and the stitcher jumped away from the tire, the easier way was to begin the spinning operation over again; is that what you mean to say?

A. Yes, sir.

x-Q. 81. Have you any idea what the percentage of stretch was in the original attachment of the plies to the core, in connection with the hand-spinning operation? I mean when the ply was stretched circumferentially around the core before you started to stitch or spin it down at the sides?

A. O, I don't remember what the stretch was down there; but later on, at some of those other factories, that depends upon the pliableness and greenness of the fabric. Take some fabric that is green and soft, will go down much further than that which is dry.

x-Q. 82. You cannot estimate, then, the percentage of original stretch at the Diamond factory?

A. No.

x-Q. 83. Do you think the stretch that was then given the fabric was as great as that that is now used in the ordinary tire machine such as the Firestone machine here?

A. Yes, we used to get as much stretch by pulling it on as they are giving it here on the machine. Pulling it on, I have taken out two and a half inches to the foot. I have pulled it down there when a man held a crowbar against the stand.

x-Q. 84. Was that the usual practice?

A. O, no! that wasn't the usual practice; but we have tested it out that way.

x-Q. 85. Do you think you got as much as a 14% stretch in connection with the old hand-spinning operation?

A. How much is that per foot?

x-Q. 86. It's the amount you are getting here on the Firestone machine.

A. Yes, I guess we did.

x-Q. 87. Did you use the same kind of fabric then that you are now using in the Firestone plant?

A. Well, as the fiber is concerned, I don't know; the heft of it was practically the same on the same ply tires they are making here.

x-Q. 88. And what is the weight of the fabric which they are now using here?

A. I can't tell you that. I have nothing to do with that part.

x-Q. 89. Have you no idea whether it is 10-ounce duck or 14-ounce duck or 18-ounce duck?

A. No, sir.

Cross-examination closed.

Deposition closed.

Signature waived.

LOUIS STARK, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Louis Stark; 40 years of age; Akron, Ohio.

Q. 2. You are employed by The Miller Rubber Company, of Akron?

A. Yes, sir.

Q. 3. What position do you hold there?

A. General Tire Department foreman.

Q. 4. How long have you been with the Miller Company?

A. Ten years.

Q. 5. Where were you before that?

A. Diamond Rubber Company.

Q. 6. How long were you there, please?

A. As near as I can figure, about 11 years.

Q. 7. When you were at the Diamond plant did you make tires by hand?

A. Yes, sir.

Q. 8. About when did you begin making tires by hand at the Diamond Company?

A. About the year 1901 and 1902.

Q. 9. Did you make them on iron cores?

A. Made them on wooden cores first.

Q. 10. When did you begin making them on iron cores at the Diamond?

A. I think I worked there about a year building tires on wooden cores.

Q. 11. So that would make it about what year you began making them on iron cores?

A. I should think, to be safe about that, 1903.

Q. 12. When you made them on the iron cores, just describe how you put the fabric on the core at the Diamond plant.

A. We pulled the fabric on by hand. The first ply was made up in an endless band.

Q. 13. How did you get the other plies on?

A. Pulled them on by hand.

Q. 14. How did you form the edges of the fabric down on the side of the core?

A. Well, there is a number of ways you could do that. I used to do it the quickest way—spinning the core, holding your stitcher on the side of the fabric and running the ply down.

Q. 15. When did you do this at the Diamond?

A. Well, I started it right after I started to build tires there on iron cores.

Q. 16. That would be in the year 1903?

A. Yes, about that time.

Q. 17. How fast did you spin the core?

A. Well, now, I don't know as I can say just how fast the core was going; but you had to spin it just as fast as you could possibly get it to spin.

Q. 18. When the core was spinning fast, what position would the edges of the fabric take?

A. Well, the faster you would spin the core, the fabric would stand out like this,—right out straight from the core.

Q. 19. When you speak of spinning it down with a stitcher, do you refer to a tool anything like Defendant's Exhibit B?

A. Just exactly.

Q. 20. Did you see any other men doing this same spinning operation at the Diamond at that time?

A. Lots of them.

Q. 21. After you came to the Miller Company ten years ago, did you make any tires by hand?

A. Made them all by hand.

Q. 22. Did you spin the fabric down as you have just described when you were at the Miller Company?

A. Sometimes.

Q. 23. When you were spinning down by hand, how did you hold the stitcher, in one hand or by both?

A. One hand you hold the stitcher. You could sit aside of your tire, spin your tire with your left hand if you was righthanded, and run your ply down with your stitcher.

Q. 24. Is that the way you did it at the Diamond Company?

A. Yes.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 25. Do you think you were able to press the stitcher against the core with the same amount of pressure as that now ordinarily imparted to a spinning or forming roll in the present well-known form of carcass-making machine?

A. Well, I think I could, yes.

x-Q. 26. Notwithstanding the fact that you held the stitcher in one hand and did not press it up against the body?

A. Didn't have to press it up against the body.

x-Q. 27. In other words, you relied simply on the muscular power in your arm and hand?

A. Yes.

x-Q. 28. Have you any idea what amount of pressure you were able to impart to the stitcher in the way you have described?

A. Well, no, not exactly. I couldn't say how much pressure I did put on. I never had any idea at all. I always got enough on there to get them down where they should be.

x-Q. 29. Do you think you were able in this manner, and holding the stitcher as you have described, to make the pressure uniform, or, in other words, the same at all times, and on all tires, and on both sides of the tire?

A. I could have at that time. I haven't done any of that work for a good many years.

x-Q. 30. How do you know that this pressure was uniform as you have described it?

A. Well, you would always know that after you got your band ply down, after you got your ply down.

x-Q. 31. I take it you did not exert your full strength in pressing the stitcher against the core?

A. That's a question I don't think I could answer.

x-Q. 32. I suppose, if the pressure had been too great, it might have retarded the rotation of the core?

A. Well, I don't think so, because it kept on spinning all the time.

x-Q. 33. You don't think you could have pressed hard enough to slow down the core in its rotation?

A. That all depends on the one arm. What I meant by that, if you didn't keep on spinning it, of course, your tire would stop. You had to keep on spinning it all the time while you were stitching the tire down.

x-Q. 34. Then you did not rely on giving the core a great momentum at the start, and allowing it to run until you got through with the stitching operation, but rather kept accelerating the core during the stitching operation; is that what you mean?

A. Kept on spinning the core all the time you were stitching the ply down.

x-Q. 35. Have you any idea how fast you rotated the core during the operation you have described?

A. No, I haven't.

x-Q. 36. Do you think it was as high as 120 revolutions a minute?

A. Well, now, I couldn't say to that at all, because I don't know.

x-Q. 37. Do you think it was as high as the rate of speed of rotation that is now given the core in ordinary carcass-making machines?

A. At different times it was. When you started the tire, why, you went pretty fast.

x-Q. 38. And then after that it got slower, did it?

A. Well, it just depended on how hard you pressed on your stitcher whether it got slower.

x-Q. 39. Then the pressure of the stitcher would have an effect at times of slowing the core down in its rotation?

A. If you didn't keep spinning it very fast with your other hand, it would.

x-Q. 40. And it would certainly have this effect when an operator used both hands to hold the stitcher?

A. You couldn't hardly do that.

x-Q. 41. Couldn't hardly do what?

A. Hold the stitcher with both hands and spin the core.

x-Q. 42. Will you kindly explain what you meant by your last answer?

A. I thought you asked me wether you held the stitcher with both hands. You don't. You only hold it with one hand.

x-Q. 43. Was that the general practice in the Diamond plant,—to hold the stitcher with one hand and turn the core with the other hand?

A. It was with them that was doing it.

x-Q. 44. Doing what?

A. Running the ply down, spinning the core.

x-Q. 45. In other words, the hand-spinning practice in the Diamond plant at the time you refer to was for the operator to hold the stitcher in one hand and simultaneously turn the core with the other hand; is that correct?

A. Yes.

x-Q. 46. When was it that you entered the Diamond employ?

A. Well, I ain't sure whether it was 1901 or 1902.

x-Q. 47. Is your memory pretty good on dates?

A. Why, I don't know. I don't think it's the best in the world on dates.

x-Q. 48. Were you ever employed in the Goodrich factory?

A. As a kid I was. Not on tires.

x-Q. 49. When was that?

A. In 1892.

x-Q. 50. You were never in the employ of the Goodrich Company after that time?

A. No.

x-Q. 51. When you went to the Diamond Company, what branch of the manufacture were you first assigned to?

A. Bicycle-tire Department.

x-Q. 52. You did not make these bicycle tires by the spinning method, did you?

A. Made them on a pole.

x-Q. 53. I take it that later on you were transferred from the Bicycle-tire Department to the Automobile Tire Department?

A. Yes.

x-Q. 54. And when was that transfer?

A. I don't just exactly know. I think I built bicycle tires about two years.

x-Q. 55. Which would make the date of the transfer when?

A. I don't think I could tell you exactly, not exactly.

x-Q. 56. You have already testified, have you not, that you began making tires in 1901 and 1902?

A. Somewheres along there. I did not say the exact year.

x-Q. 57. You are reasonably sure it was between 1901 and 1902?

A. 1901 and 1903.

x-Q. 58. And it might have been even later than that, as late as 1903?

A. I wouldn't say for sure, but I don't think it was.

x-Q. 59. How long after you were transferred to the Automobile Shoe Department was it before iron cores were introduced?

A. I don't know as I can give you any exact time on that.

x-Q. 60. Did you ever, previously to to-day, make an affidavit covering the facts concerning the facts about which I am now inquiring?

A. I think I did, yes.

x-Q. 61. You refer, do you not, to an affidavit made by you on the 1st day of December, 1917, in a case which I shall briefly entitle "Firestone *vs.* Seiberling"? You remember it, don't you, Mr. Stark?

A. Yes.

x-Q. 62. You said in that affidavit that you entered the employ of the Diamond Company in the year 1900. Is that statement correct?

A. As near as I know, it is.

x-Q. 63. You also said in that affidavit that about the year 1903 you were transferred from building bicycle tires to making automobile tire casings. Was that statement correct?

A. I guess about as near as I can figure out.

x-Q. 64. You also stated in that affidavit that, when you started in this work, they were manufacturing tires on wooden cores, but, after about a year, an iron core similar to that now in use was introduced. Was that statement correct?

A. Don't know whether the time was just exactly correct. Can't say right to the day nor the hour nor the month.

x-Q. 65. In that affidavit you also fixed the date for spinning tires in the manner described by you as the year 1904. Is that correct?

A. Well, we got to doing it right along. I don' know whether it was 1904, or 1903, or 1902. I know I got it when I started over there.

x-Q. 66. You have said in your testimony to-day that you began making tires by hand at the Diamond Company in the year 1901 and 1902.

A. Well, maybe I did.

x-Q. 67. Well, maybe you did what,—maybe you said it, or maybe you started?

A. Maybe I started to make tires.

x-Q. 68. Notwithstanding the fact that, in the earlier

affidavit, you said that it was about the year 1903 that you were transferred from building bicycle tires to making automobile tire casings?

A. That's as near as I can figure it out.

x-Q. 69. As a matter of fact, you are not even certain to-day exactly when it was that this happened?

A. When I was transferred over? I can't tell you the day, and I can't tell you the year, right now; but it was around that time.

x-Q. 70. And it was not until a year after that that iron cores were introduced?

A. Well, I couldn't say how long it was, because I don't remember.

x-Q. 71. That is what you said in the affidavit. How do you account for that?

A. Well, I tried to give it to you as near as I could. That's a long time to remember.

x-Q. 72. I suppose you realize that there is some little conflict between the facts as you have stated them in the affidavit and the facts as you have testified to them to-day, do you not?

A. I don't know whether there is or not.

x-Q. 73. At the Diamond works did you ever make automobile tires casings in any other way than by the hand-spinning method?

A. Yes.

x-Q. 74. What was the other way?

A. Stitch your ply down with one hand, and pull your ply down with the other hand to the place where it belongs.

x-Q. 75. In this stitching operation to which you refer did you move the stitcher in a path substantially like that shown you in the sketch Plaintiff's Exhibit No. 7?

A. Something similar to that, yes.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. SEWARD:

Rd-Q. 76. In the affidavit to which counsel has referred you also said, "I am able to positively fix the date 1904 as a date at which time I was spinning tires in the manner indicated, as I was married in December of that year and I know that I had been making tires by hand and spinning them on iron cores for some time before the date of my marriage." That's correct, is it not?

A. Yes.

Rd-Q. 77. Mr. Stark, it is a fact that you are an unusually large and strong man, isn't it?

A. I always have been.

Rd-Q. 78. You weigh over 200 lbs., don't you?

A. Yes, sir, 242.

Rd-Q. 79. In the tire-making machines with which you are familiar, are the stitching-rolls pressed in against the fabric on the core by the operator himself?

A. Yes, sir.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. ROGERS:

Rx-Q. 80. You mean to say you are not familiar with any tire-making machines wherein the rolls are pressed in by springs or weights?

A. The only machines I ever worked around are the ones I am working around now.

Rx-Q. 81. Did you ever see any machines in which the rolls are pressed inwards by springs or weights?

A. Yes.

Rx-Q. 82. What machines do you refer to in your last answer?

A. I have seen our own machines.

Rx-Q. 83. And are those machines the only ones in which the rolls are pressed inwards by springs or weights, which you have seen?

A. They are the only machines I have seen.

Rx-Q. 84. I ask you once again to tell me whether or not you have ever seen a tire-making machine in which the rolls were pressed inwards by springs or weights, other than the machines you refer to as your own machines?

A. I seen the Thropp machine.

Rx-Q. 85. Are the rolls pressed inwards there by springs or weights?

A. Yes.

Rx-Q. 86. Now, have you ever seen any other machine in which the rolls are pressed inwards by springs or weights?

A. No.

Rx-Q. 87. Have you ever seen a Goodyear machine?

A. No.

Rx-Q. 88. Have you ever seen a Goodyear machine in the shop or shops of any of the Goodyear licensees?

A. No.

Rx-Q. 89. Have you ever seen a Firestone machine?

A. No.

Recross-examination closed.

Deposition closed.

Signature waived.

Adjourned until the following morning at 9:30 o'clock.

Resumed, pursuant to adjournment, Wednesday, April 30, 1919, at 9:30 o'clock A. M. Present: as before.

WILLIAM G. GREEN, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. William G. Green; aged 46 years; Akron, Ohio.

Q. 2. You are employed by The Firestone Tire & Rubber Company?

A. Yes.

Q. 3. And are you an inspector of tire carcasses?

A. Yes, sir.

Q. 4. How long have you been employed by the Firestone Company?

A. 1906.

Q. 5. You have been here since 1906?

A. Yes.

Q. 6. Do you know Mr. William Heller?

A. I do.

Q. 7. Was he here when you came here?

A. Yes, sir.

Q. 8. Had you been employed by The B. F. Goodrich Company before you came to the Firestone Company?

A. Yes, sir.

Q. 9. Did you make automobile tires at the Goodrich Company?

A. I did part of the time.

Q. 10. Did you make these on iron cores?

A. Yes, sir.

Q. 11. Will you please describe how you put the fabric on the cores when you made tires on iron cores at the Goodrich plant?

A. We hung a core up on posts. We had posts with pins sticking out, and we hung it up by hand and pulled the fabric on.

Q. 12. Do you mean that you hung the core on the pin?

A. Yes, sir.

Q. 13. And that you pulled the fabric on the core by hand?

A. Yes, sir.

Q. 14. After you had pulled the fabric on the core, how did you get the edges of the fabric down on the sides of the core?

A. We had to spin the table around and stitch it down by hand.

Q. 15. What do you mean by the "table"?

A. Why, we had a revolving table, and use a paddle sometimes, and lots of times we used the stitcher most of the time, well, biggest part of the time.

Q. 16. How did you turn the core?

A. Why, was a ball-bearing table, and they whirled it, see? get it going fast, and they held the stitcher there.

Q. 17. Did you do that yourself?

A. Yes, sir.

Q. 18. Do you mean the core was on the table?

A. Yes, sir.

Q. 19. When you had it whirling fast, what position did the edges of the fabric take?

A. Well, the upper edge of the fabric on top would flare up, naturally.

Q. 20. How did you hold the stitcher?

A. Why, kind of a slanting position, and then shove stitcher right straight down to bead line.

Q. 21. Did you hold the stitcher in one hand or two?

A. Well, sometimes we would hold it in one, and sometimes two.

Q. 22. Was the stitcher you used anything like this tool, Defendant's Exhibit B?

A. Yes, sir, practically the same thing. Of course, different sizes of them sometimes.

Q. 23. Did you see any other men at the Goodrich plant stitch down the fabric by whirling the core as you have described?

A. Yes, sir.

Q. 24. When you came to the Firestone Company, in 1906, what work did you do?

A. Building tires.

Q. 25. How did you put the fabric on the core when you built those tires?

A. Hung them up on stand. We had a stand, upright stand; pull them on by hand same as the other.

Q. 26. How did you stitch the fabric down?

A. Why, stitch them down with stitcher. Hold the stitcher right on. Was handier than the other way.

Q. 27. State whether or not you whirled the core?

A. We did. Well, not when you pull on the fabric. When you done the stitching.

Q. 28. How fast did you whirl the core?

A. As fast as we could whirl it. The faster the better.

Q. 29. And, in making those tires, did you hold the stitcher in one hand or in two?

A. Usually in one hand.

Q. 30. Was that stitcher similar to this Defendant's Exhibit B?

A. Yes, sir.

Q. 31. Did you see any other men at the Firestone plant in 1906 stitching down the fabric in that way?

A. I did.

Q. 32. When you whirled the core in stitching at the Firestone plant, what position did the edges of the fabric take?

A. Naturally flared out.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 33. You have spoken of another way of laying the fabric down on the sides of the core. What was that other way?

A. Well, what do you mean, Goodrich or Firestone?

x-Q. Both?

A. Why, at the Goodrich there was only one way. We laid it on the table and whirled the core and the table, and stitched the plies down.

x-Q. 35. Was that the case with all sizes of tires at the Goodrich plant?

A. On different sizes that I worked on it would work out that the smaller tire would work better.

x-Q. 36. Did all the workmen in the Goodrich plant operate in the manner you have described, on all kinds of tires, and in that way only?

A. I couldn't answer that; I don't know.

x-Q. 37. You never saw a tire made in the Goodrich plant except in the manner that you have described, namely, where you whirled the core around on a horizontal table?

A. There were tires made there; they got a different stand after that, an upright stand; they could lay it down or stand it up,—a later model.

x-Q. 38. Well, admitting that there were two kinds of core supports, one the flat, whirling table, and the other the stand that could be adjusted to different positions, I am now asking you whether or not you ever saw a tire made in the Goodrich factory in any other way except by the spinning operation?

A. Not these certain kind of tires I didn't.

x-Q. 39. I now ask you again whether or not you ever saw any kind of tires made in the Goodrich factory by any other method than the spinning operation which you have described?

A. Yes, sir.

x-Q. 40. Now tell me about it, what it was.

A. Why, the bicycle tires we used to make on cores or drums or different ways of making tires.

x-Q. 41. Then bicycle tires were the only tires that were made in the Goodrich plant in any other way except by the spinning operation that you have already described; is that correct?

A. Pretty large plant! don't know whether they made any other different than where I was, or not.

x-Q. 42. Did you ever see a tire stitched down in the Goodrich plant?

A. Why, that's what we called stitching them down. That's what I described.

x-Q. 43. I show you a sketch, Plaintiff's Exhibit No. 7; and ask you to state whether or not you ever saw a ply laid down on the side of a core by the stitcher following a path substantially like that shown in exhibit. I am referring, of course, to your experience in the Goodrich plant prior to 1906.

A. I have saw them made that way, I know.

x-Q. 44. Then your previous answers were erroneous, were they?

A. Large-size tires.

x-Q. 45. Then your previous answers were wrong, were they?

A. How do you mean wrong?

x-Q. 46. In other words, then, there were at least two methods of stitching down the fabric on the sides of the core that were in use at the Goodrich plant at the time you were there?

A. Well, the men worked different; they had different methods, yes, of stitching them down.

x-Q. 47. Some men, then, spun the tire down; and others stitched them down by the sawtooth method; is that correct?

A. Well, I expect—I think it is all right; some of them worked them down that way.

x-Q. 48. Did you ever see anybody work down a tire in the Goodrich plant by that sawtooth method?

A. I did.

x-Q. 49. Notwithstanding the fact that you stated, in your answer to x-Q. 41, that it was a pretty large plant, and you "don't know whether they made any other different than where I was, or not". That answer was incorrect, was it?

A. Why, what way do you mean?

x-Q. 50. Do you still state that, because the Goodrich

plant was a large one, you don't know whether or not, in other parts of the shop, tires were made in any other way except by the spinning operation, as substantially stated by you in your answer to x-Q. 41?

A. I still claim that's the only way I knew of them making the tires.

x-Q. 51. Then what becomes of your answer to x-Q. 48, in which you stated that you actually saw tires worked down in the Goodrich plant by the sawtooth method?

A. I told you that they worked them both ways.

x-Q. 52. And you saw them work them both ways?

A. Yes.

x-Q. 53. Now, what kind of tires did you see made by the sawtooth method?

A. What do you mean—automobiles or bicycles?

x-Q. 54. I repeat my question. What kind of tires did you see made by the sawtooth method?

A. Automobile tires.

x-Q. 55. All sizes of automobile tires?

A. Yes, as far as I knew they was making them all.

x-Q. 56. Did you ever make a tire by the sawtooth method?

A. Some plies I have stitched down that way, yes, sir.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. SEWARD:

Rd-Q. 57. Do you mean by your testimony that some of the piles were put down by whirling the core, and some of the plies put down by the sawtooth method?

A. I do.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. ROGERS:

Rx-Q. 58. Do you mean that, in the same tire, some of the plies were laid down by whirling the core, and other plies were laid down by the sawtooth method?

A. I seen it done that way, yes, sir.

Rx-Q. 59. Was that the general practice,—to lay down part of the plies by the sawtooth method and part by the spinning method?

A. Yes, they worked a good deal like that.

Rx-Q. 60. Is that what you used to do yourself?

A. I worked like that myself.

Rx-Q. 61. Now tell me which plies you laid down by the sawtooth method, and which plies the spinning method.

A. Wouldn't make any particular difference either way, which plies I did.

Rx-Q. 62. Then, in making tires, you simply mixed up the two methods as your fancy dictated; is that correct?

A. Yes, sir.

Rx-Q. 63. In other words, sometimes, when you felt like it, you would run down a few plies by one of the methods, and then run down the remaining plies by the other method; is that correct?

A. That's the way we worked.

Rx-Q. 64. Did your inspector know that you were mixing the two methods in the same tire?

A. Couldn't help but see us. He was right around there all the time.

Rx-Q. 65. And he approved of this way of mixing the two methods in the same tire, did he?

A. He never said anything about it to us, whether it was right or wrong.

Rx-Q. 66. Then it was a mere whim of your fancy whether to use the spinning method or the sawtooth method?

A. Well, if it wasn't right he would have told us to stop, I suppose.

Rx-Q. 67. I repeat the question. Then it was a mere whim of your fancy whether to use the spinning method or the sawtooth method?

A. We supposed it was right, and convenient to do that.

Rx-Q. 68. Please tell me why it was convenient to mix the two methods.

A. We could stitch down faster with a hand-stitcher.

Rx-Q. 69. Then, if it was quicker, why didn't you use it throughout the tire and not use the other one at all?

A. Well, I don't know why; we mixed the two methods together, that's all; I don't know why we did do it.

Rx-Q. 70. Did you make any tires at the Goodrich plant entirely by the sawtooth method, without any spinning in it at all?

A. No, we had to spin them.

Rx-Q. 71. Why did you have to spin them?

A. To run down our plies.

Rx-Q. 72. You couldn't lay down the ply by the sawtooth method?

A. O, it might be done, I suppose!

Rx-Q. 73. Wasn't it frequently done at the Goodrich plant? I mean, Did not tire-makers at the Goodrich plant frequently lay down plies by the sawtooth method?

A. I don't know that; I couldn't tell you whether they did or not.

Rx-Q. 74. Haven't you already said that you did it yourself?

A. It could be done, I suppose.

Rx-Q. 75. I repeat the question. Haven't you already said that you did it yourself?

A. I put part of the plies down that way; and could put them all down, I suppose, if I wanted to.

Rx-Q. 76. When you were in the Goodrich plant, did any one instruct you how to lay down the plies of the tire?

A. Why, we used stitcher when we can, and the paddle when we could. Those were the most convenient. That's the only instructions I had.

Rx-Q. 77. When you refer to the use of a paddle, you mean using the paddle according to the sawtooth method, do you not?

A. Well, no, that doesn't describe it exactly.

Rx-Q. 78. Well please describe the use of the paddle that you have just referred to.

A. Why, we used to take and push it straight down with the paddle to the bead line.

Rx-Q. 79. Did you lay down many plies by the use of the paddle in that way?

A. We laid down part of them that way, and part of them the other way,—with the stitcher.

Rx-Q. 80. Did you ever use the stitcher to work the ply down on the side of the tire substantially along the sawtooth path?

A. Yes.

Rx-Q. 81. Now tell me, please, how you spun down the plies on large-size tires.

A. Well, I worked on small sizes when I was there, mostly.

Rx-Q. 82. Did you never make large-size tires in the Goodrich plant?

A. As far as I remember, I don't believe I made over a 4-inch tire down there.

Rx-Q. 83. How did the other tire-makers at the Goodrich plant lay down the plies on the large-size tires?

A. I wouldn't want to say how they put them down; for I don't know.

Rx-Q. 84. Don't you remember, or did you never see a large-size tire made in the Goodrich plant?

A. They worked up in the other end of the room from where our small tires were.

Rx-Q. 85. Did you ever see a large-size tire made in the Goodrich plant?

A. I have seen them working on them, but I didn't get down to see just how they did that part of it.

Rx-Q. 86. Then you don't know whether the large tires were made in the Goodrich plant by the sawtooth method, or how they were made?

A. I wouldn't want to say that I knew how they were made.

Rx-Q. 87. I repeat the question. Then you don't know whether the large tires were made in the Goodrich plant by the saw tooth method, or how they were made?

A. I will answer that, No.

Rx-Q. 88. Did you ever make any large-size tires at all at the Goodrich?

A. Nothing above four, to my knowledge.

Rx-Q. 89. If it was quicker to use the spinning method, why did you mix in the sawtooth method with it?

A. All depends on the condition your cores were or fabric. Sometimes one would work better, sometimes the other.

Rx-Q. 90. When would the sawtooth method work better?

A. Why, if the fabric was stiff and hard, it would be easier to get it down that way.

Rx-Q. 91. Wouldn't you have the same kind of fabric throughout a single tire?

A. The conditions of your fabric differ a lot of times coming from the Mill Room.

Rx-Q. 92. Would the conditions vary in the different plies of the same tire?

A. It does, often.

Rx-Q. 93. Therefore, when you were handling a layer of fabric that was stiff and hard, you would use the sawtooth method to shape it down?

A. Yes, sir. It would work it better that way.

Rx-Q. 94. What did you call, in the Goodrich plant, the method of laying down the fabric on the side of the

core, which we have been naming here the "sawtooth method," as shown in Plaintiff's Exhibit No. 7?

A. Well, I wouldn't know what they did call it, really. Give you a stitcher and a paddle and a set of tools and tell you to go to it.

Rx-Q. 95. Suppose you had wanted to describe that sawtooth method in the Goodrich plant, what would you have termed it?

A. Using a paddle would be the only thing, or stitching it down, the only thing I would know to call it.

Recross-examination closed.

Deposition closed.

Signature waived.

WARREN C. GREGG, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Warren C. Gregg; aged 47 years; Akron, Ohio.

Q. 2. Are you employed by The Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. What's your position here?

A. Inspector of tires.

Q. 4. How long have you been employed here?

A. Be eight years in next July.

Q. 5. Before you came here did you work for The Diamond Rubber Company?

A. Yes, sir.

Q. 6. When did you leave the Diamond's employ?

A. I left the Diamond—now, I was there twice.

Q. 7. When did you leave the last time?

A. In 1911.

Q. 8. When did you leave the first time?

A. 1907.

Q. 9. When you were at the Diamond the first time, did you make tires by hand?

A. Yes.

Q. 10. Please describe how you put the fabric on the core in making those tires.

A. We had, to start with, a band; it was an endless band; that two of us stretched over a core. Then we worked it down with a stitcher.

Q. 11. Describe how you worked the fabric edges down on the sides of the core with the stitcher.

A. Well, if we worked it down according to our instructions, it was done with stroke. Often they would spin the core, and then would hold the stitcher against the sides of the core; hold the stitcher there—of course, if we had speed enough to start with, we would run it clear down.

Q. 12. Clear down to what?

A. Bead line. Generally a little below.

Q. 13. How fast did you spin the core?

A. Well, we figured on spinning it fast enough to make it run until we got this fabric run down to the bead line.

Q. 14. When the core was spinning, what position did the edges of the fabric take?

A. Why, ordinary stand straight out, flare out.

Q. 15. Was the stitcher you used anything like this tool, Defendant's Exhibit B?

A. Very much like it, but it didn't have the ball-bearings.

Q. 16. Did you hold the stitcher in one hand or two?

A. Two.

Q. 17. Did you see any other men spin down the fabric in this way at that time?

A. Yes, sir.

Q. 18. At any time before you left the Diamond Company the first time, which you have said was in 1907, did you make tires on a core that was driven by a belt?

A. Yes, sir.

Q. 19. Now, please describe what you did in making tires on that core; I mean in pulling the fabric on. Describe the core, and how it was driven.

A. The core was hung on a spindle of the tread machine; and we stretched the band over by hand the same as we did on all of the others; and the next ply was pulled on by hand; and then, in running that ply down, I used the stitcher, while the tire was in motion.

Q. 20. How was the belt arranged?

A. We had tight and loose pulleys.

Q. 21. Do you know how fast it was driven by the belt?

A. No, I couldn't tell you.

Q. 22. When it was in motion, in what position were the edges of the fabric?

A. Be flaring out.

Q. 23. What kind of a stitcher did you use in putting down those fabric edges?

A. Used common stitcher like that (witness pointing to Defendant's Exhibit B). I also had a stitcher made, a concave stitcher, concave edge. That was used for turning the fabric over the tip of the bead.

Q. 24. How did you hold the stitcher that was like Defendant's Exhibit B when making the tires on this belt-driven core?

A. Sometimes I held it with both hands like that, and other times I used a fork that I got there, for a rest; and I could also get more pressure to steady it.

Q. 25. How far down did you spin the fabric on the sides of the core in that way?

A. Before the beads were put on, I stitched it down to the bead line, or below.

Q. 26. About how long were you using that belt-driven core as you have described?

A. I think about a month.

Q. 27. Are you sure that was before you left the Diamond, in 1907?

A. Yes, sir.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 28. You have referred to the method you were taught when you went to the Diamond Company. Did that method involve the use of the stitcher in a saw tooth path substantially like that shown in the sketch Plaintiff's Exhibit No. 7?

A. Yes.

x-Q. 29. You have spoken about pulling the fabric on to the core by hand. Have you any idea what percentage of stretch you gave the fabric in pulling it on?

A. I haven't.

x-Q. 30. In using the hand-spinning method you have been talking about, did you use it on all sizes of cores?

A. No, sir. Only on the smaller sizes, anything from 4-inch down.

x-Q. 31. Why didn't you also use it on the larger-size cores?

A. My reason was that it took too long to get a large core in motion.

x-Q. 32. In other words, you found difficulty in spinning the heavier cores?

A. Yes, sir.

x-Q. 33. Is that the only reason?

A. Well, I couldn't say positively that it is. The only other reason that I can think of is the different shapes of different cores.

x-Q. 34. Were the larger-size cores of different shape from that of the small-size cores?

A. I think they were.

x-Q. 35. What kind of tires did you make then, straight side, clinchers, or what?

A. I never made any straight-side tires. They were clincher tires; that is, what I experimented on with the power-driven core.

x-Q. 36. I was referring more particularly to the tires which you made by the ordinary hand-spinning method. What were they—straight-side or clinchers?

A. Mine were all clinchers.

x-Q. 37. Even earlier than 1907?

A. Yes, sir.

x-Q. 38. In using the spinning method on the larger-size tires, did you have any other difficulty than that involved in imparting the proper momentum to the heavy core?

A. Yes, sir.

x-Q. 39. What were these other difficulties?

A. We had the difficulty of keeping the fabric from—well, you might say wrinkling.

x-Q. 40. There was a tendency to wrinkle, was there, in the plies of the larger-size tires?

A. Yes, sir.

x-Q. 41. Do you know why that difficulty arose?

A. On account of the more stock, it seems, to be worked in the same surface. Now, what I mean by the larger tire doesn't mean large in one way. Now, you take a 36 or a 37 x 4, they work very nicely in the spinning method; but a 36 or a 37 x 5 or 5½ would be more difficult.

x-Q. 42. If I undestand you correctly, what you mean to say is, that, in the tires of larger cross-section, there was more fabric to lay down; and, for that reason, it

was more difficult to do it by the spinning method; is that correct?

A. That expresses the idea, yes.

x-Q. 43. In connection with these tires of larger cross-section, when you pulled the strip on to the core, there would be a greater amount of side-stretch along the edges of the strip, would there not, than in connection with cores of smaller cross-section?

A. I don't believe that one answer can be applied to all cores. I think there would be more loose fabric in a large tire on the edges of the ply; I mean on large cross-section tire.

x-Q. 44. And this rendered more difficult the subsequent absorption of this fullness in the sides of the tires?

A. Well, you are right. There is a point, probably, you may not know in this tire business. Now, for instance, in some of these larger sizes the bead is set further in from the outer periphery of the core; and consequently there was more fabric to absorb.

x-Q. 45. And consequently, in these cases, you applied the skirts of the ply to the sides of the core, or of the tire, by the sawtooth method of stitching?

A. Supposed to.

x-Q. 46. How do you fix your dates as given by you in your direct testimony? By memory alone?

A. Not entirely. I have a record of some of my work and dates.

x-Q. 47. What was the exact date, for instance, when you worked on this experiment with the belt-driven core?

A. I wouldn't attempt to give you the exact date.

x-Q. 48. Well, can you give the year?

A. Not positively.

x-Q. 49. You say you worked on it about thirty days, to the best of your recollection?

A. About that.

x-Q. 50. And then what line of work did you take up?

A. I went back to building the ordinary way, customary.

x-Q. 51. Coming back now to the so-called "hand-spinning operation," have you any idea with what degree of pressure you held the stitcher against the core?

A. No, sir, I couldn't answer it in pounds.

x-Q. 52. I suppose that, if you pressed too hard, there would be a liability to slacken down the speed of the core, would there not?

A. Sure!

x-Q. 53. I suppose, also, that, if you pressed too hard, and because of the fact that you were holding the stitcher-wheel at an angle to the core, there would be some liability that the stitcher-wheel would slip?

A. Yes, sir.

Cross-examination closed.

Deposition closed.

Signature waived.

Recessed until 1:30 o'clock P. M. of the same day.

Resumed, after recess, at 1:30 o'clock P. M. of the same day. Present: as before.

TOD J. MELL, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Tod J. Mell; aged 43 years; Akron, Ohio.

Q. 2. Are you employed by The Firestone Tire & Rubber Company?

A. I am.

Q. 3. What is your position?

A. Technical advisor to the superintendent.

Q. 4. Were you ever connected with The Republic Rubber Company, of Youngstown, Ohio?

A. I was.

Q. 5. When did you start with that concern?

A. August 11, 1905.

Q. 6. How long did you remain with them?

A. 11 years.

Q. 7. What was your position there?

A. First, I was manager of the Tire Department; and then as Experimental Engineer.

Q. 8. About how long were you manager of the Tire Department?

A. Five years.

Q. 9. Did they make tires by hand at the Republic Company?

A. They did at first, in the early days.

Q. 10. About when did they start to make tires by hand at the Republic Company?

A. Made the first tires in the fall of 1905. Got the department well under way in 1906.

Q. 11. Will you describe how the fabric was put on the core when tires were made by hand at the Republic Company in 1906?

A. The fabric was cut the proper width on the bias, a strip made the proper length to reach round the core of the tire, after being stretched. I should have said at first that the core was cemented, in order that the fabric would stick to the iron. After the ply had been stretched on the core and spliced, it was rolled down, starting at the tread and working down well over the sides. As the fabric was stretched, it tended to lay down to some extent over the sides of the core. The operator, after he had rolled the tread, rotated the core until a sufficient speed was obtained, and then, at first by means of his roller, and later with his stitcher, rolled the fabric on to the core.

The motion was then stopped and the tire turned in a horizontal position; and in this position the operator finished working the fabric on to the core. The plies were put on in this manner until sufficient plies under the bead had been placed; then the bead was placed and additional plies of fabric stretched, and rolled on to the tire; after which the tire was trimmed at the bead and the rubber side wall and tread applied. The tire was then cured in the usual manner that all full-molded tires are cured in.

Q. 12. Was the tool to which you have referred as the "roller" similar to this cylindrical roller, Defendant's Exhibit C?

A. It was.

Q. 13. Was the tool which you have referred to as the "stitcher" similar to this disk-like roller, Defendant's Exhibit B?

A. It was.

Q. 14. About how much of the fabric on the side was laid down by the use of the stitcher; I mean how much in a radial direction?

A. Probably about half way down the side, which depended somewhat on the skill of the operator, an expert tire-maker being able to roll it down further than a green operator.

Q. 15. When the core was rotating, what position did the edges of the fabric take?

A. Owing to the centrifugal force, they stood away from the core to some extent.

Q. 16. Was this method of building tires which you have described the regular practice at the Republic Company in 1906?

A. It was.

Q. 17. How did the tire-maker hold the stitcher in his hands when the core was rotating?

A. That depended somewhat on the tire-maker him-

self, different tire-makers holding the stitcher in a slightly different position. Usually, I should say, with the thumb up on the handle; and varying the position accordingly with the surface of the tire he was working on.

Q. 18. Do you know at about what angle, with respect to the plane of the core, he would hold the wheel of the stitcher?

A. That would be very hard for me to say, the operator using his judgment as to the best position.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 19. Was the method you have described the only method used by the Republic Company to make tires?

A. That was the accepted method up until the time a machine was used.

x-Q. 20. Until the time of the adoption of machines, no other method was employed in the Republic plant?

A. Nothing except possibly experimental method or methods.

x-Q. 21. And this same method was used on all sizes of tires?

A. It was.

x-Q. 22. How large tires did you make at that time at the Republic Company?

A. Up to and including 5-inch. 3-inch to 5-inch.

x-Q. 23. You never used the so-called "reciprocating stitching method" to lay down the skirts of the fabric on the core?

A. Just what do you mean by "reciprocating method"?

x-Q. 24. For instance, I call your attention to a sketch, Plaintiff's Exhibit No. 7, which sets forth the sawtooth or serrated path of the stitcher to which I have referred in mentioning the reciprocating method.

A. After the fabric was applied to the core and the tire spun and the operator had worked down with his

stitcher, while the tire was spinning, all the fabric that he could, he stopped the core and used the paddle, and sometimes a stitcher, to stretch the fabric and make it lay smoothly the balance of the space to the inside diameter of the tire. I wouldn't say that he worked it down that way. The path shown in the sketch is at an angle with the radial line of the tire. The method used in stretching the fabric on with a paddle was to stretch very near to radial line; in other words, we worked towards the axis of the tire, instead of at an angle.

x-Q. 25. In other words, you employed a series of reciprocating strokes somewhat like those shown in Plaintiff's Exhibit 7, except that the strokes were not at the angle there indicated; is that correct?

A. It is.

x-Q. 26. And that angle was more acute with reference to the radius than that illustrated in the exhibit?

A. Yes.

x-Q. 27. Did you ever make any tires at all at the Republic Company, wherein this reciprocating stitching action was employed to carry the skirts of the fabric all the way down to the bead line?

A. I do not believe that we ever did. All of the tires were rolled down to some extent, varying with the experience of the operator, before the paddle was used.

x-Q. 28. How far down did the operator work on the tire with a cylindrical roller like Defendant's Exhibit C?

A. Somewhat over the crown of the core. This also varied with the operator, some using their rollers further down on the side than others.

x-Q. 29. What percentage of stretch, so far as you can estimate it, was given the fabric in its original circumferential attachment to the core?

A. The stretch was varied considerably. The structure of the fabric made considerable difference. A

closely-woven fabric, for instance, would admit of considerably less stretch than a comparatively loosely-woven fabric; so it is very hard to give any exact, or even approximate, percentage of stretch. Tires were manufactured in an experimental way, some with a very great deal of stretch, the fabric being stretched practically to its limit. Other experimental tires were made with fabric stretched very little. My judgment would be that the stretch used in the earlier days of tire-making varied greatly.

x-Q. 30. I suppose that, in connection with a core of small cross-section, the amount of subsequent side-forming is inversely proportional to the initial circumferential stretch; is that correct?

A. I say yes.

x-Q. 31. For instance, you take a core of small cross-section, say three inches across; and then you stretch the fabric thereon so as to get an 18 or 20 per cent elongation; there is very little additional forming action necessary to apply the fabric to the side of the core; is that correct?

A. Yes, not a great deal of additional forming need be done. However, the fabric had to be applied without wrinkles; and even on a small tire this took considerable care, the fabric never coming down where it lay on the core in its correct position.

x-Q. 32. It has sometimes been the practice, has it not,—you will understand that I am not referring particularly to the Republic Company,—in connection with cores of small size and suitable contour, to rely almost entirely on the circumferential stretching in the formation of the tire on the core?

A. Certain companies, in order to make the operation of applying the fabric easy, stretch their plies to a considerable extent; but even when this is done I would not say that they relied principally upon the stretch, as it was always necessary to place the fabric in its proper position by other means.

x-Q. 33. You have stated that, in the hand-making of tires at the Republic plant, the core was first turned in a vertical position, and then subsequently adjusted to a horizontal position. Tell me what was done when the core was thus placed in a horizontal position.

A. After the fabric was rolled down on the core as much as possible by spinning, the tire was turned on its side, as practically all the tire-makers preferred this position in working the fabric to the bead with the paddle as previously described by me.

x-Q. 34. What was the weight of the fabric, as well as you can remember it, that was used in this hand-making of tires in the Republic plant?

A. Probably very nearly the same weight as is used at present. I know that we changed the construction of the fabric several times. But the weight, I should imagine, remained within an ounce or two above or under that which is at present used, which would be approximately 17-1/4 ounces to the square yard.

x-Q. 35. The observations that you have recorded this afternoon are not based upon your own personal operation of the methods, as I understand it, but rather on what you saw done by employees at the Republic plant?

A. Principally on observation, although I have made a few tires.

x-Q. 36. When was it you left the Republic Company, Mr. Mell?

A. In 1916.

x-Q. 37. And when did you cease your service as manager of the Tire Department there?

A. About 1910 or 1911.

x-Q. 38. And when was it that the method of manufacturing you have already described became the fixed method of the Republic Company?

A. Practically when we started to manufacture tires, as we started with experienced operators.

x-Q. 39. When did the Republic Company give up the method you have been describing?

A. I would say they never gave it up entirely. The operation, to a great extent, is the same now that it ever was.

x-Q. 40. Referring, of course, to hand-made tires?

A. Well, even machine-made tires; with the exception that, after the machine was developed, it wasn't necessary to use the paddle at any time. However, expert operators in the old hand method were able to make tires with very little use of the paddle.

x-Q. 41. When was it, if it is a fair question, that the machines were introduced into the Republic plant?

A. There is no reason that I shouldn't answer, except that I don't know the exact year that we went over on to the machine method. It was about—the machines were in use, I think, before I left the Tire Department. It was right along there sometime. In 1911, probably.

Cross-examination closed.

Deposition closed.

Signature waived.

JOHN W. THOMAS, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. John W. Thomas; aged 39 years; Akron, Ohio.

Q. 2. What is your occupation?

A. General Superintendent of The Firestone Tire & Rubber Company.

Q. 3. Is the Firestone Company a large manufacturer of tires?

A. I would say fairly large, not the largest.

Q. 4. You remember the suit of F. A. Seiberling against The Firestone Tire & Rubber Company involving the tire-making machines, which was decided a few months ago by the United States Court of Appeals in Cincinnati?

A. I recall the case.

Q. 5. Do you remember a machine that was put in evidence on behalf of the Firestone Company in that case, and which was asserted to embody the construction shown in the Belgian patent to Mathern, No. 194,721, of September 20, 1906?

A. Yes.

Q. 6. Did you ever see that machine operated?

A. Yes.

Q. 7. Whereabouts did you see it operated?

A. At the Firestone plant.

Q. 8. Did you see tires made on it?

A. Yes.

Q. 9. Do you know whether tires made on it were put in actual use on automobiles?

A. Yes.

Q. 10. Were they so used?

A. Yes.

Q. 11. What can you say as to whether or not those tires gave good service?

A. We put two of the tires on one of our test-cars. Those two were removed at approximately 1900 miles of service; and then were placed as exhibits in Cincinnati. There were four other tires that were placed on Mr. W. R. Murphy's car, of our Employment Department. A report from Mr. Murphy indicates that those tires gave good service. The exact mileage is not known. He estimates the mileage at about 5,000.

Q. 12. Did this report from Mr. Murphy come to you in the regular course of business as Superintendent of the Firestone plant?

A. No, I asked him for it.

Q. 13. Was this report a regular factory report?

A. No.

Q. 14. Will you state whether or not, in your opinion, the tire-making machine referred to was a practical machine for making commercial tires?

A. I would say so. I would say it was.

Q. 15. Will you state whether or not, in your opinion, the tires you saw made on it were commercial tires?

A. Yes, they were.

Q. 16. Do you remember a set of photographs which were put in evidence in the Seiberling against Firestone case, relating to this tire machine I have mentioned?

A. I do.

Q. 17. Just look at those photographs I hand you and tell me if they are a duplicate set.

A. In my best judgment, they are.

Q. 18. These photographs have each been numbered, and a descriptive title applied to each, which are the same as the numbers and titles used for the corresponding photographs in the Seiberling-Firestone case. Will you examine these titles and see if they are substantially correct descriptions of the photographs?

A. Yes, they are.

Q. 19. Were you present when these photographs were taken?

A. I was.

Q. 20. And are they true photographs of the machine referred to, and of several different stages of the operation of making tires thereon, as described in the titles?

A. In my judgment, they are.

Q. 21. At the present time, the Firestone Company is using tire-making machines with revolving cores and radially-moving spinning rolls?

A. Yes.

Q. 22. Are these spinning-rolls pressed laterally

against the core by springs or weights, or by the muscular power of the operator?

A. By hand.

Q. 23. The tire-making machine which I referred to as being put in evidence in the Seiberling against Firestone case has been shipped to The John E. Thropp's Sons Company, at Trenton, New Jersey, the defendant in this present case; is that a fact?

A. Yes.

Mr. Seward: I offer in evidence the set of 18 photographs identified by the witness; and ask that they be marked collectively as Defendant's Exhibit D.

Direct-examination closed.

No cross-examination.

Deposition closed.

Signature waived.

WILLIAM R. MURPHY, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. William R. Murphy; aged 29 years; Akron, Ohio.

Q. 2. You are employed by The Firestone Tire & Rubber Company?

A. Yes.

Q. 3. Do you drive an automobile?

A. Yes, sir.

Q. 4. What kind of a car?

A. A Stearns-Knight.

Q. Touring car?

A. Yes, sir.

Q. 6. Were four test-tires put on your car here at the Firestone plant last year?

A. Yes, sir.

Q. 7. In what month were they put on?

A. During the month of January.

Q. 8. That's January, 1918?

A. January, 1918, yes, sir.

Q. 9. Have any other test-tires been put on your car since that time?

A. No, sir.

Q. 10. How long did you run those tires on your car?

A. They ran from January to June of 1918, and from December until the present date.

Q. 11. What were you doing between June and December, 1918?

A. I was with the Ordnance Department at Rock Island, Illinois.

Q. 12. And was your car laid up during that period?

A. Yes, sir.

Q. 13. Do you mean to say that all four of the tires are still on your car?

A. One of these tires was scrapped about January 1, 1919; the second tire was scrapped three weeks ago, about April 1, 1919. The remaining two are on the car to-day.

Q. 14. Have you had one of those taken off to-day?

A. One of them taken off to-day.

Q. 15. Is this tire here in the room the one that was taken off to-day?

A. Yes, sir.

Q. 16. Can you state about how far you had driven the tire that was scrapped in January of this year?

A. The one that was scrapped in January probably gave very close to 5,000 miles.

Q. 17. How about the one that was scrapped about April 1st, this year?

A. It probably ran a little more than 5,000; probably be a difference in there of four or five or six hundred miles.

Q. 18. And about how far have you driven this month?

A. Well, during the month of April I estimate that I drive between five and six hundred miles.

Q. 19. Is this tire which you have just identified still in serviceable condition?

A. Yes, sir.

Mr. Seward: The tire will be marked for identification "Defendant's Exhibit E".

Q. 20. How did the service you received from those four tires compare with the service you received from other tires, on the same car,—in a general way?

A. The service received, I believe, was as good as the average, and better than some.

Direct-examination closed.

No cross-examination.

Deposition closed.

Signature waived.

GUY L. EVANS, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Guy L. Evans; aged 35 years; Akron, Ohio.

Q. 2. You are employed by The Firestone Tire & Rubber Company?

A. Yes, sir.

Q. 3. Do you remember the so-called "Mathern tire-making machine" that was set up in the basement of the United States Courthouse, in Cincinnati, last year?

A. Yes, sir.

Q. 4. Were you one of the men who operated that machine before the judges of the Court of Appeals?

A. I was.

Q. 5. Did you help make tires on that machine here at the Firestone plant last year?

A. I did.

Q. 6. Did you put any of those tires on the automobile of Mr. William R. Murphy.

A. I did.

Q. 7. You saw those put on the car yourself?

A. Yes, sir.

Q. 8. About when was that?

A. Well, shortly before we went to Cincinnati.

Q. 9. You mean before you operated the machine in front of the judges?

A. Yes, sir.

Q. 10. I call your attention to a tire here in the room, which has been marked for identification "Defendant's Exhibit E", and ask you if that looks like one of the tires you put on Mr. Murphy's car?

A. It does.

Q. 11. Did you see any other test-tires put on Mr. Murphy's car at the time stated, except those that were made on the so-called "Mathern" machine?

A. No, sir.

Q. 12. As I understand your testimony, you did not put those tires which were made on the so-called "Mathern" machine on Mr. Murphy's car yourself, but you saw them put on by men; is that correct?

A. Correct.

Q. 13. Now I will ask you, Did you yourself put, or did you see any one else put, any other test-tires on Mr. Murphy's car, at the time stated, except those that were made on the so-called "Mathern" machine?

A. No, sir.

Q. 14. How many of those tires made on the so-called "Mathern" machine did you see put on Mr. Murphy's car at the time stated?

A. Four.

Mr. Seward: The tire marked for identification as Defendant's Exhibit E, and referred to in the testimony of this witness, is offered in evidence as Defendant's Exhibit E.

Direct-examination closed.

No cross-examination.

Deposition closed.

Signature waived.

Adjourned until Friday morning, May 2, 1919, at 9:30 o'clock.

Resumed, pursuant to adjournment, Friday, May 2, 1919, at 9:30 o'clock A. M. Present: as before.

MARK W. ROE, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, age, and residence.

A. Mark W. Roe; aged 46 years; Youngstown, Ohio.

Q. 2. What is your occupation, Mr. Roe?

A. Mechanical Engineer. At the present time, Consulting Engineer of The Republic Rubber Company, of Youngstown, Ohio.

Q. 3. How long have you been with the Republic Company?

A. Since July, 1917.

Q. 4. Have you been Consulting Engineer during that time?

A. I have, sir.

Q. 5. Is the Republic Company a large tire manufacturing concern?

A. Probably about sixth or seventh in the United States.

Q. 6. Where were you engaged before you went to the Republic Company?

A. Directly previous to going to the Republic Company, I was engineer for the McGraw Tire Company at East Palestine, Ohio, for practically two years. Previous to that I was employed with The Diamond Rubber Company, and its successor, The B. F. Goodrich Company, from April, 1907, until August, 1915.

Q. 7. What position did you hold when you went to the Diamond Company in April, 1907?

A. Assistant Engineer.

Q. 8. How long did you hold that position?

A. Approximately three months, when I was made Chief Engineer of the works.

Q. 9. Do you know how the tires were made by hand at the Diamond Company in 1907?

A. I do.

Q. 10. Please describe how the fabric was formed on the core at the Diamond Company at that time.

A. The fabric was received by the men cut in bias strips. The ends of these strips were placed upon the core and stretched around the core by the manual power of the operator, after which the core, with the ply of fabric, was revolved by hand, and spinning wheel or stitcher, hand-operated, was used for stitching down the fabric around what would form the bead.

Q. 11. Just describe how the spinning or stitching tool was held by the operator, and how it was operated.

A. The core was caused to rotate by the left hand of the operator, spinning tool being held in the right hand, the spinning end of the tool downward, and forced against the tire, usually starting from the center or outside peri-

phery and working in a spiral line, forcing the fabric to the core, as the spinning tool was advanced, radially ... ard the center of the core.

Q. 12. Was the core held in a vertical position or horizontal position?

A. Both ways. The earlier stands were usually held in a vertical position.

Q. 13. About how fast, if you know, were the cores rotated?

A. It would be hard to say, but I should judge from 50 to 60 revolutions per minute. It would average about that.

Q. 14. Was the stitching or spinning tool to which you have referred anything like this Defendant's Exhibit B?

A. Very much. Practically the same thing.

Q. 15. Are you sure this method was followed at the Diamond Company in 1907?

A. Yes.

Q. 16. Do you have tire-making machines at the Republic Company which have power-rotated cores and radially-moving spinning-rolls for forming the fabric on the sides of the core?

A. We do.

Q. 17. How are those spinning-rolls forced laterally against the sides of the core?

A. In some by hand lever, and others by foot lever.

Q. 18. Are any springs or weights used for this purpose?

A. No, sir.

Q. 19. At the McGraw Company, when you were there, —that is, 1915 to 1917,—did they have tire-making machines with power-rotated cores and radially-moving spinning-rolls for forming the fabric on the sides of the core?

A. They did.

Q. 20. How were those spinning-rolls forced laterally against the sides of the core?

A. They were forced by hand lever in both cases.

Q. 21. Were springs or weights used for this purpose?

A. No.

Q. 22. Do you know how tires are made at The Knight Tire & Rubber Company, of Canton, Ohio, at the present time?

A. I do. They are made by machine and hand.

Q. 23. Does the machine have power-rotated core and radially-moving spinning-rolls for forming the fabric on the sides of the core?

A. It does.

Q. 24. How are those spinning-rolls pressed laterally against the sides of the core?

A. By hand levers and foot levers.

Q. 25. Are any springs or weights employed for this purpose?

A. No.

Q. 26. Was this also true in 1917?

A. The same condition has existed since my employment with The Republic Rubber Company corporation.

Q. 27. Will you state whether or not, at the McGraw Company, in 1915 to 1917, some of the tires were made by hand?

A. They were.

Q. 28. How was the fabric put down on the sides of the core in that operation at that time?

A. Stitched down by hand-stitcher in practically all cases.

Q. 29. Will you just describe that hand stitching so we will understand what you mean?

A. Same operation as described in the Diamond plant.

Q. 30. Will you answer the last three questions, but substituting the Republic Company for the McGraw Company, and the years 1917 to 1919 for the years 1915 to 1917?

A. I will.

Q. 31. Please answer them.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 32. Are you sure that your connection with the Diamond Company began in April, 1907?

A. Yes, sir.

x-Q. 33. There is no doubt whatever as to that date?

A. I think not.

x-Q. 34. You think there is no possibility that it might have been later than that, a few months later?

A. If my recollection is correct, it was April 1, 1907.

x-Q. 35. Have you endeavored recently to verify that date in any way?

A. No, I have not; had no occasion to.

x-Q. 36. Is it not a fact that, at that time, there was another method of forming the fabric on the sides of the core in use at the Diamond plant?

A. Not that I know of in general use.

x-Q. 37. Were not tires made by hand at the Diamond plant, in which the stitcher followed what we term the "sawtooth" path, as indicated, for instance, in the sketch which I now show you, Plaintiff's Exhibit No. 7?

A. So far as I remember, wrinkles or uneven places obtained in stitching a tire were smoothed out by paddle or stitcher along the principle as shown in the "Sawtooth Path Sketch".

x-Q. 38. Was this practice of eradicating wrinkles in this manner frequently followed?

A. Quite frequently.

x-Q. 39. And you never saw at the Diamond plant a tire made by hand wherein the skirts were laid down entirely by this sawtooth method?

A. No, I can't say that I have. The paddle or the stitcher was used with wrinkles to lay down at times, but not in the complete operation.

x-Q. 40. Does that statement also hold true in relation to your entire experience at the Diamond plant, or do you mean only at the time you have been discussing, namely, the spring of 1907?

A. To the best of my knowledge, it was in common use at the Diamond plant,—to stitch them down that way. I mean in common use to stitch them down by the stitcher, by rotating the core.

x-Q. 41. Then, if I understand you correctly, so far as your knowledge goes, no tire was ever made in the Diamond plant by the use of this sawtooth method, but all tires were made by the use of spinning method you have already described?

A. No, I don't mean to state it that way. There may have been some tires made this way, according to the sawtooth method, but not to my general knowledge.

x-Q. 42. Have you any idea as to the amount of pressure that was applied to hold the stitcher against the sides of the core in the hand-spinning method?

A. No, I have not.

x-Q. 43. You are unable to estimate it in pounds?

A. That will vary with the pressure the man was able to apply by hand.

x-Q. 44. That is to say, some operators were enabled to press the stitcher against the core with greater force than others?

A. Yes.

x-Q. 45. Would you say generally that the amount of pressure employed in this Diamond spinning process was as great as that now applied in the several machines you have been discussing?

A. Hardly. Not as uniform.

x-Q. 46. In other words, you think that the pressure applied at the Diamond plant in the hand-spinning method was not only less than that now applied in the machine, and moreover was not uniform?

A. Yes, sir.

x-Q. 47. Do you think that, in this spiral mode of procedure that you have described, it is desirable to have the pressure on the stitcher uniform?

A. I do.

x-Q. 48. And do you think that it is desirable to have a heavier pressure than was possible in the hand-spinning method?

A. Not necessarily.

x-Q. 49. In other words, you think that the amount of pressure exerted on the stitcher in following the spiral path is more or less immaterial?

A. No, it should not be less than a certain amount, nor greater than a certain other amount, the definite limits of which I have not fixed.

x-Q. 50. But undoubtedly a vastly greater amount of pressure can be applied in the machines which you have described than was possible in the Diamond hand-spinning?

A. Yes.

Cross-examination closed.

Deposition closed.

Signature waived.

Mr. Seward: I request counsel for the plaintiff, to exhibit, some time prior to June 10, 1919, the "Plaintiff's Exhibit No. 2, State Machine," to defendant's experts, for examination, to operate the said machine in building one or more tire carcasses in the presence of the said experts, and to operate the said machine in building one or more tire carcasses at the low and high rotative speeds of the core, named in the specification of the patent in suit, which are, respectively, six revolutions per minute and two hundred and seven revolutions per minute.

I also ask counsel for plaintiff to give me reasonable notice of the time and place for such exhibition and demonstration.

Notarial certificate waived.

Adjourned subject to new notice.

UNITED STATES DISTRICT COURT.

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING, Plaintiff, v. THE JOHN E. THROPP'S SONS COMPANY, Defendant.	In Equity. No. 614.

Defendant's Testimony.

Testimony taken in behalf of the defendant, pursuant to notice and agreement of counsel, before Charles J. Carey, a Notary Public within and for Summit County, in the State of Ohio, at the office of said Notary Public, Room No. 726, Second National Building, in the city of Akron, Summit County, Ohio, beginning on Tuesday, June 10, 1919, at 11 o'clock A. M.

APPEARANCES:

ROBERT FLETCHER ROGERS, LUTHER E. MORRISON and CHAUNCEY L. LANDON, Esqs., for the plaintiff; and

E. CLARKSON SEWARD, Esq., for the defendant.

HARVEY J. BITTAKER, a witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. Please state your name, residence and occupation.

A. Harvey J. Bittaker; Akron, Ohio; Assistant Man-

ager of the Cord Tire Department of The Firestone Tire & Rubber Company, Akron, Ohio.

Q. 2. How long have you been with the Firestone Company?

A. Since May 1, 1913.

Q. 3. Where did you work before that?

A. The Diamond Rubber Company, Akron, Ohio.

Q. 4. How long were you with the Diamond Company?

A. From December, 1896, to May 1, 1913.

Q. 5. State some of the positions you held there.

A. Inspector in the Bicycle Tire Department, also foreman in the Bicycle Tire Department; inspector and foreman in the construction of automobile tires.

Q. 6. Did the Diamond Company make automobile tires by hand on iron cores?

A. Yes, sir.

Q. 7. About what year did they begin that?

A. About the year 1900.

Q. 8. Did they continue that practice for some time thereafter?

A. Yes, sir.

Q. 9. Did you see the tires made on the iron cores?

A. Yes, sir.

Q. 10. Please describe how they put the fabric on the iron core at about the time they began to make tires that way, and during the following years.

A. The construction of the tire began by the application of a first ply, which was put on in a band form. The core was then revolved, and the plies were stitched down on the side of the core, additional plies being added that were not put on in the band form were rolled and stitched down in a similar manner.

Q. 11. What kind of a tool was used for the rolling operation to which you have referred?

A. There was no roller used on the band ply; but the

several additional plies were rolled down, that is, on top of the core, with a flat roller, and some with a curvature roller. They were rolled down to a point on the core about half way between the top and the bead line. Then the stitcher was applied, and the balance of the fabric was stitched down with a stitcher about three and a half inches in diameter, and about a one-sixteenth inch face.

Q. 12. By the face do you mean the edge?

A. The edge.

Q. 13. Of what material was this stitcher composed?

A. Usually made from round steel material something similar to a line shaft. Steel.

Q. 14. Was it mounted in any kind of a handle?

A. Wooden handle.

Q. 15. When you referred to a straight roller, did you mean a cylindrical shaped roller?

A. Yes.

Q. 16. And the curvature roller had a curved face?

A. Yes.

Q. 17. Was this curved face, convex or concave?

A. Concave.

Q. 18. How fast did the man rotate the core while stitching down the fabric?

A. In the early stages of the tire construction, rotating of the core while stitching down the plies was sort of termed as a criminal offense among the employees. Shortly after the tire construction had advanced, it was more common to see the workmen rotate the core at a very high speed while applying the fabric with the stitcher.

Q. 19. About what year was it that it became more common to see this?

A. About the year 1902 or 1903.

Q. 20. While the core was rotating as you have described, what position did the edges of the fabric take?

A. The edges of the fabric were sort of flared out or

spread out on the sides while the core was being rotated.

Q. 21. How did the workman hold the stitcher?

A. By the handle, in whatever angle that was best suited to his own convenience in stitching down the fabric.

Q. 22. About what was the weight of the fabric?

A. Practically the same grade of fabric that is used to-day. I think it was about 17½-ounce.

Q. 23. Do you know Mr. Warren C. Gregg?

A. I do.

Q. 24. Was he working at the Diamond Company when you were there?

A. Yes, sir.

Q. 25. State whether or not you ever saw Mr. Gregg, at the Diamond Company, putting the fabric on a core that was power driven.

A. I did see him applying the fabric.

Q. 26. Please describe what you saw him do, including a description of the core.

A. The core, after being placed on the power-driven stand, was cemented; and the construction of the tire proceeded as follows: the first ply of fabric was applied to the core in a band form, which was put on by two men. The band was then centered on the core, so as to be sure that both sides of the fabric would come down to the bead line before the power-driven machine was started in motion. Then the belt was slipped from the loose pulley to the tight pulley, which started the core to rotate. Mr. Gregg then applied the hand-stitcher to the side of the tire, and began to stitch the fabric down to the bead line. After both sides of the band had been fastened to the core in this manner, additional plies were applied in a like manner, until it came time for the application of the beads. After the beads had been applied, additional plies were added to the tire, and stitched down in a similar manner, until a point on the tire was reached that

contained the bead. Then a grooved stitcher was used in turning the fabric down over the bead, until it reached the toe of the bead. Then the straight stitcher was again applied, and the remainder of the fabric was stitched down to the bead line.

Q. 27. While the core was rotating at the beginning of this stitching operation, what position did the edges of the fabric take?

A. The edges of the fabric were flared out on the sides similar to the same position that they presented when tire builder was spinning the core by hand.

Q. 28. What was this power-driven apparatus that you have just mentioned?

A. The power-driven apparatus used by Mr. Gregg at this time was a treading stand that is used for applying breaker-strips and treads on tubular tires.

Q. 29. By the breaker-strip do you mean the piece of loosely woven fabric that goes between the tread of the tire and the tire body?

A. I do.

Q. 30. When was it that you saw Mr. Gregg do this work?

A. I do not remember the exact date, but I was married the year 1908. This experiment that Mr. Gregg was trying out took place about two years previous to the above date, that is, the date of my marriage. The reason I say about two years previous is because I remember the date—about the date when the first tire-building machine was installed at The Diamond Rubber Company; and the experiments on the power-driven stand was the first step toward the construction of a tire machine. It took approximately six years for the development of a complete machine by which to build tires at The Diamond Rubber Company. The first machine was installed in the fall of 1911, or the spring of 1912.

Q. 31. About how long was Mr. Gregg working on

this belt-driven core, putting on the fabric, at the time you mention?

A. Off and on, about six or eight weeks. He was making demonstrations for several men who were planning construction of the tire machine.

Q. 32. Are you positive that this was prior to 1908?

A. Yes.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 33. You spoke of a stitcher having a concave face. Will you please tell me what you mean by that description.

A. By the description of the stitcher with a concave face I mean a stitcher about one-half inch thick, with a groove cut in it about the same shape as the bead, or, in other words, a V shape.

x-Q. 34. You mean there was a groove in the edge of the roller that was V shape in cross-section?

A. Well, yes, I guess you would call it cross-section. I would.

x-Q. 35. And do I understand that it was this form of stitcher that was used to run down the skirts of the fabric on the sides of the core?

A. No. This stitcher was used only turning the fabric over the bead.

x-Q. 36. Is your memory pretty good on dates?

A. Well, usually, yes, if not too ancient.

x-Q. 37. Are you sure, for instance, that the Diamond Company used iron cores in the year 1900, which is 19 years ago?

A. Yes.

x-Q. 38. Assuming that other witnesses have testified that iron cores were not used by the Diamond Company until 1903 or 1904, would you say they were wrong?

A. I would until they presented the proof.

x-Q. 39. Where is Mr. Gregg now?

A. Mr. Gregg is working at the Firestone Tire & Rubber Company, Akron, Ohio.

x-Q. 40. Have you had any recent talks with Mr. Gregg?

A. I have.

x-Q. 41. And did you discuss with him this operation which you have testified to that you saw him employ?

A. I did.

x-Q. 42. What kind of machine did the Diamond Company introduce into operation in 1911 or 1912, concerning which you have already testified?

A. Well, the machine that was introduced in 1911 or 1912 was a two-man machine; in other words, one man working on each side of the core. These men constructed the tire by stitching down the fabric while the core was rotating, by using the stitcher which was controlled by the hands, in about the way the tires had previously been made by hand.

x-Q. 43. At the time you left the Diamond plant, was that machine still in operation there?

A. It was.

x-Q. 44. And do you know whether or not it continued in operation after you left the Diamond plant?

A. After I left The Diamond Rubber Company, I learned through other parties that the machine had been —that there had been additions made to the machine, including some of the B. F. Goodrich machines.

x-Q. 45. What was the nature of the additions?

A. I do not know.

x-Q. 46. What features of the Goodrich machine were embodied in it, if you know?

A. I do not know.

x-Q. 47. Do you know whether or not, in the Diamond plant (now a part of the Goodrich Company), the form

of machine you have described is still employed,—I mean a machine provided with a rotating core, in connection with which a man stands on each side of the core to spin the fabric down by hand?

A. I do not.

x-Q. 48. In other words, you have no idea how the skirts or sides of the fabric are formed on the sides of the core in the Diamond machines of to-day?

A. I do not.

x-Q. 49. Do you know how the Goodrich machines are constructed and operated?

A. I do not.

x-Q. 50. Why was the hand-spinning operation at the Diamond plant regarded as a species of criminal offense, as you have stated it?

A. In the beginning of tire construction, it was more theoretical than anything else that the threads of which the fabric was composed could not be kept at a 45-degree angle while being applied to the tire, if stitched down while the core was rotating; but, after the mechanics who were studying the proposition got into it more thoroughly, they found out that applying the fabric while the core was spinning was not detrimental to the tire, as they had previously thought.

x-Q. 51. How were the tire-makers expected to lay down the sides or skirts of the fabric on the core, at this time you have been talking about?

A. Up until the first experiments with construction on a machine, they applied the fabric to the tire with a hand-stitcher, but only moved the core as fast as was deemed necessary to keep the threads at a 45-degree angle.

x-Q. 52. How did the stitcher move, at the time you have just mentioned, in connection with the slowly rotating core?

A. The stitcher rotated slightly while placing the fabric against the sides of the core.

x-Q. 53. In what direction did the operator move the stitcher, at the time last mentioned?

A. Forward.

x-Q. 54. What do you mean by forward?

A. The core—well, in other words, away from the man.

x-Q. 55. Now, is it not a fact, Mr. Bittaker, that the operator was expected and instructed at this time, in the Diamond plant, to form the sides or skirts of the fabric to the core by a succession of short strokes inward toward the center of the core, and at a slight angle thereto?

A. Yes.

x-Q. 56. In other words, by what is known as the "hand-stitching method", as distinguished from the hand-spinning method?

A. Yes.

x-Q. 57. That is to say, the path of the stitcher in this authorized form was substantially like that shown in the sketch I exhibit to you, and which is marked "Plaintiff's Exhibit No. 7"?

A. Substantially like it, with the exception that the angle may not have been exactly the same.

x-Q. 58. Why did the authorities at the Diamond plant think, at the outset, that the hand-spinning method was detrimental to the tire?

A. Well, I stated previously that it was theoretical that they condemned that practice at first, thinking that the threads which composed the fabric could not be kept at a 45-degree angle.

x-Q. 59. Was that their only reason for condemning the practice at the outset?

A. That is the only reason of which I had ever been taught.

x-Q. 60. You think they based this conclusion on theory, and not on practice?

A. Later demonstrations showed that it was only theory.

x-Q. 61. Why did the workmen prefer to use the hand-spinning method to the sawtooth method?

A. The fabric could be applied more easily and in less time, naturally.

x-Q. 62. How were the tire-makers paid at that time, —by piece-work, or were they on salary?

A. Piece-work.

x-Q. 63. And they found that the hand-spinning method was easier and simplier and quicker; and that, on the piece-work basis, they would make more money? Is that correct?

A. No, that isn't correct.

x-Q. 64. Why is it not correct?

A. Because the men building tires at this time had a piece-work limit, and were allowed to earn a certain amount of money each day.

x-Q. 65. And, in earning this maximum amount of money, they found that the hand-spinning method was easier and quicker? Is that correct?

A. Yes, sir.

x-Q. 66. Was that maximum limit ordinarily reached by the workmen in making tires by the sawtooth method?

A. Yes.

x-Q. 67. Then, from the workmen's viewpoint, the hand-spinning method seemed an easier and quicker method of earning their money? Is that correct?

A. They considered that the hand spinning was not so laborious. It was easier, but wasn't quicker. Easier on their arm. That was the point.

x-Q. 68. Then you do not think that the hand-spinning method was quicker than the sawtooth method?

A. I do.

x-Q. 69. Then it was quicker as well as easier?

A. Yes, it was quicker as well as easier.

x-Q. 70. Then your answer to x-Q. 67, wherein you say, "It was easier, but wasn't quicker", was a mistake, was it?

A. Well, it wasn't exactly a mistake: it was simply wanting to bring out my point to show that the workmen would not be benefited from a financial standpoint by the hand spinning.

x-Q. 71. But you agree now that it was both easier and quicker, whatever you may have meant in your answer to x-Q. 67?

A. I do.

x-Q. 72. Coming back to the Gregg matter, I should like to ask you again why it is that you fix the date as you have done?

A. In fixing the date, it was in reply to Mr. Seward's question.

x-Q. 73. Very well, then; I shall change the form of the question. How do you fix the date of the Gregg matter as you have done?

A. As stated previously about being married in 1908, and stating that it was about 1905 or 1906 when Mr. Gregg was experimenting on this work, I will state that a new building was under construction at the time of Mr. Gregg's experiment, and was not completed for about three years later, which was the year in which I was married.

x-Q. 74. And how long was that building under construction?

A. I believe that, from the time they started to move the houses away from Jackson Street until the completion of the building, was about three years. Mr. Gregg was experimenting on this power-driven machine at the time they started to move the houses from Jackson Street, and it was then contemplated that this building was to be equipped with tire-making machinery such as could be developed from experiments made by Mr. Gregg and several mechanics.

x-Q. 75. And, when the building was completed, was it equipped with machines of this kind?

A. It was not equipped with machines until about

three years later, three years after the building was completed.

x-Q. 76. When were you married, Mr. Bittaker?

A. 1908.

x-Q. 77. Would you give me the exact date, please?

A. September 15th.

x-Q. 78. Then Mr. Gregg performed his experiments about three years previous to your marriage; is that correct?

A. No. Mr. Gregg performed the experiments about five or six years previous to my marriage.

x-Q. 79. Do you know when Mr. Gregg says he performed the experiments?

A. I do not.

x-Q. 80. It is rather difficult, is it not, trying to fix precise dates like this, after a period of fifteen years or so?

A. Not if you have recollections of certain happenings that occurred to freshen your memory.

x-Q. 81. And that is the reason you have been able to testify with such positiveness as to the date when Mr. Gregg performed his experiments?

A. Yes, sir.

x-Q. 82. I call your attention to the fact that you have already given three different dates for Mr. Gregg's experiment. You first said it was in the year 1906. You then said that it was in 1905 or 1906. And you last said that it was five or six years previous to your marriage, which would make it in 1902 or 1903. Now, will you tell me which of these assorted dates is the correct one?

A. About 1905.

x-Q. 83. Your statement that it was five or six years before your marriage was incorrect, was it?

A. I don't believe I made that statement.

x-Q. 84. I call your attention to x-Q. 78, and your answer thereto. Do you now believe that you made the

statement that Mr. Gregg performed his experiments five or six years before you were married?

A. I don't believe it now. If I did, I meant that it was five or six years from the time Mr. Gregg made his experiments until the first tire machines were installed in the new building of which I speak; and that was the year 1911 or early in 1912.

x-Q. 85. You say you don't believe it now. Do you think the Examiner made a mistake in transcribing your answer?

A. The transcriber either made a mistake, or I misunderstood the question from the examiner.

x-Q. 86. Well, which do you think is the correct explanation?

A. I think the correct explanation is the last one that I have made, regarding Mr. Gregg's experiments.

x-Q. 87. I ask you again whether you think the Examiner (Mr. Carey) made a mistake or you misunderstood the question?

A. It's possible that I misunderstood the question.

x-Q. 88. Do you know when Mr. Gregg left the employ of the Diamond Company?

A. I do not.

x-Q. 89. Do you remember whether it was before or after you were married?

A. It was after I was married.

x-Q. 90. Mr. Gregg says it was in 1907. Do you think he was wrong?

A. He ought to know better than me, but I am positive that Mr. Gregg was working in the new building which I spoke about previously.

x-Q. 91. And that building was completed about the time of your marriage?

A. Building was completed in the fall of 1908.

x-Q. 92. And you remember distinctly that Mr. Gregg was working in that new building that was not completed until the fall of 1908?

A. I would not condemn Mr. Gregg's own date, but it seems to me that Mr. Gregg worked in this building. He might have left the employ of the Company in 1907, as he states, and returned at a later date, as is often the case.

x-Q. 93. You think, then, that is the explanation,—that he left the Diamond Company in 1907, and came back to it and afterwards worked in the new building?

A. I do.

x-Q. 94. Did he resume his experiments on the power-driven core when he returned the second time to the Company?

A. Not to my knowledge.

x-Q. 95. And you are certain that the experiments he conducted were in the old building, and not in the new one?

A. I am.

x-Q. 96. When Mr. Gregg finished his experiments, what did he do then?

A. He either went back to building tires, as he had previously done, or went on inspecting.

x-Q. 97. You don't remember which?

A. I believe he went on inspecting.

x-Q. 98. But you are not sure of it?

A. No.

x-Q. 99. Do you remember how soon it was Mr. Gregg came back into the employ of the Diamond Company the second time?

A. I do not. I don't know whether there was a second time.

x-Q. 100. But you saw him at work in the new building that was not completed until 1908?

A. I did.

x-Q. 101. Then, if he left in 1907, he must have come back?

A. I have no knowledge of him leaving in 1907.

Cross-examination closed.

Deposition closed.

Signature waived.

HARRY K. RAYMOND, the next witness called on behalf of the defendant, being first duly sworn, in answer to interrogatories propounded to him by Mr. Seward, deposes and says as follows:

Q. 1. What is your name, residence, and occupation?

A. H. K. Raymond; Akron, Ohio; Second Vice-President, in charge of production, of the B. F. Goodrich Company, Akron, Ohio.

Q. 2. Did you at one time have charge of the tire manufacturing department of the Goodrich Company?

A. I did.

Q. 3. During what period, about?

A. About between 1900 and 1910.

Q. 4. I show you a copy of U. S. Patent to A. E. Vincent, No. 794,473, dated July 11, 1905. Do you recognize the machine shown in that patent?

A. I do.

Q. 5. Will you state whether or not the Goodrich Company ever had a machine like that?

A. They did.

Q. 6. When was that machine received by the Goodrich Company?

A. In about December, 1906.

Q. 7. Was it used after it was received?

A. It was.

Q. 8. About how long was it used?

A. I should say possibly eight months, possibly a year.

Q. 9. About when was it first used?

A. About February, 1907.

Q. 10. About how many tires were made on it by the Goodrich Company during the year 1907?

A. Between seventeen and eighteen thousand.

Q. 11. State whether or not those were commercial tires.

A. They were.

Q. 12. Will you state whether or not there was any arrangement whereby a royalty was paid to Mr. Vincent on those tires?

A. There was.

Q. 13. Were the royalties paid?

A. They were.

Q. 14. And those tires were sold, were they?

A. They were.

Mr. Seward: The Vincent patent shown to the witness will be offered in evidence in connection with the testimony of Mr. Frank N. Waterman, who will be defendant's expert.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 15. Do you know of any similar Vincent machines now in use, Mr. Raymond?

A. At the present time? I do not.

x-Q. 16. Did the machine operate satisfactorily with you?

A. It did.

x-Q. 17. Entirely satisfactorily?

A. At that period of time, yes.

x-Q. 18. You mean the tire standard was not, perhaps, quite so exacting then as later on?

A. Not at all that. I mean that machine was at that period a perfectly satisfactory machine. It was developed to produce more tires, at a less cost.

x-Q. 19. Were the tires of as good quality?

A. They were.

x-Q. 20. Did you have any difficulty in the cam mechanism that operated the hammers, that you recall?

A. No material difficulty, no.

x-Q. 21. But there were some imperfections in that action, were there not?

A. I shouldn't say so. I don't think there was anything mechanical that couldn't have been cared for.

x-Q. 22. Were the original stretching devices for the fabric satisfactory in their mode of operation, as you recall it?

A. I think so. They made perfectly good tires.

x-Q. 23. How about the devices for placing the clincher beads? Do you recall whether or not they were satisfactory?

A. They served the purpose at the time the machine was in operation. Improvements, of course, have been made in that, and other parts of the art, since then.

x-Q. 24. Was it a single machine or double machine?

A. Double machine.

x-Q. 25. Let's see, part of the work was done on one machine, and the remainder of it on another?

A. Quite correct.

x-Q. 26. And, briefly speaking, how was the work divided between these two machines? Tell me very briefly. How much was done on one, and how much on the other?

A. The first section embraced the means for stretching the fabric and putting it on the core in superimposed plies; and also was provided with a series of little hammers which beat upon the sides of the plies thus stretched on the core and patted and attached them to the core and to each other. The other part of the machine was provided with devices for attaching and forming the canvas around the bead, and facilities provided for trimming.

x-Q. 27. As I understand it, this Vincent machine system was superseded by the present Goodrich machines?

A. It was.

x-Q. 28. Why did you make the change, Mr. Raymond, from Vincent machines to the present style?

A. In the natural line of progression.

x-Q. 29. In other words, the Goodrich machine is a better machine than the Vincent machine?

A. A more productive; faster productive machine.

x-Q. 30. More economical?

A. More economical of operation.

x-Q. 31. Could you tell me what percentage of stretch you secured in the original Vincent machine? I am talking now of circumferential stretch?

A. I should say was approximately the same as is now the common practice.

x-Q. 32. About how much would that be?

A. Well, about 18 per cent.

x-Q. 33. In other words, on this Vincent machine the fabric was pretty well stretched down over the sides of the core?

A. It was.

x-Q. 34. And, of course, to that extent the amount of side-forming was correspondingly reduced?

A. I think, Mr. Rogers, that the amount of stretch and the shape of the fabric on the Vincent machine conformed very closely to what is considered good practice to-day.

x-Q. 35. The only thing I am particularly after is the amount of stretch.

A. That is about 18 per cent, which gives the contour of the fabric.

x-Q. 36. Of course, some companies don't use that much, and others use more?

A. I believe it is the current practice to vary the amount of stretch according to the size of the tire in relation to its diameter. You must of necessity suppose the diameter for a given stretch.

x-Q. 37. Was there any liability to the formation of air-pockets in the Vincent practice?

A. I don't believe so. Not to my recollection.

Cross-examination closed.

Deposition closed.

Signature waived.

Notarial Certificate waived.

UNITED STATES DISTRICT COURT

DISTRICT OF NEW JERSEY

FRANK A. SEIBERLING
Plaintiff

v.

THE JOHN E. THROPP'S SONS CO.
Defendant.

In Equity.
No. 614.

Defendant's Testimony.

Testimony taken in behalf of defendant, pursuant to notice and agreement of counsel, before C. B. F. DAVIS, Notary Public in and for the County of Middlesex, State of Massachusetts; at the plant of the Hood Tire Company, Watertown, Mass., on Thursday, June 5, 1919, beginning at eleven A. M.

APPEARANCES:

For plaintiff: ROBERT FLETCHER ROGERS, Esq. and LUTHER E. MORRISON, Esq.

For defendant: E. CLARKSON SEWARD, Esq.

WILLIAM W. DUNCAN, being duly sworn, deposes and testifies as follows; in response to questions from Mr. Seward.

Q. 1. Please state your name, residence and occupation.

A. William W. Duncan, Watertown, Mass.; president, Hood Tire Company.

Q. 2. How long have you been connected with the tire business?

A. Since 1906.

Q. 3. How long with the Hood Tire Co.?

A. The Hood Tire Co. was formed as a selling Company for the Hood Rubber Co. in 1914. Prior to that time I was with the Hood Rubber Co. from 1905.

Q. 4. Was the Hood Rubber Co. making automobile tires by hand in 1905 and 1906 and 1907?

A. They started making tires in the spring of 1906.

Q. 5. And continued making tires in 1907?

A. Tires were made continuously from 1906 until 1911 by hand.

Q. 6. Please describe how the fabric was placed on the core in making tires by hand at the Hood Rubber Co. in 1906 and 1907.

A. The core was mounted upon what was termed the spider, this spider consisting of a hub with three radial arms. Upon one of the arms was attached a handle for the purpose of rotating the spider and core. The hub was bored to fit upon a projection of the supporting arm upon which it would revolve. This supporting arm was curved in such a way as to miss hitting the core by about four to six inches, and then curved back into the line of the plane of the core, continuing in this line over the top of a bench. It was held on the top of the bench by two clamps one of which contained a set screw, so that the core and spider could be held either in a vertical or a horizontal position, or any position between, by clamping or unclamping the set screw. For applying the fabric to the core, the core was placed in vertical position; a piece of fabric was furnished the operator of proper width to cover the core from side to side and approximately twelve percent less in length than the circumferential measure of the top of the core. I have omitted to mention that on the hub of the spider was a pawl attachment whereby the pawl engaging with the hub could hold the core fixed in one position. The operator took one end of the fabric in his hands, throwing the balance of length over his shoulder. He cemented a small spot on

the top of the core and attached the end of the fabric to this spot. He then stretched the fabric from that spot onto about eighteen inches of core circumference. Then moved the position of the core so that the point of contact with the fabric was again at the top position, setting the pawl to hold it again in that position, and again stretched the fabric another twelve to eighteen inches of the circumference. He continued the stretching operation until the piece of fabric covered the entire circumference at the top of the core section, and lapped the end of the fabric about one inch over his starting point. This left the core with an endless piece of fabric covering its outer circumference and because the fabric was shorter than the outer circumference of the core, made it conform to the cross section contour down to a point between one and one and three-quarter inches from the center line of circumference. This amount would vary with the size of the core; on a three inch core it would contact about one inch from the center line of circumference; on a four and a half inch core it would contact around one and three quarter inches. But the point of contact on the side would always end at approximately the same percentage height above the cutting line of the core. By the cutting line I mean the point at the so-called toe of the bead where the tongue of the core attaches. It is approximately the point at which the toe of the bead is trimmed for removing excess width of fabric.

At the edge or end of the point of contact of fabric on the shoulder of the core, the remaining width of the ply stood out at approximately right angles to the core, because that was the length to which the fabric was cut before application. It was then necessary to apply these skirts of fabric as we called them to contact with the remainder of the core as far down as the cutting line. This was done with what was called a stitching or spin-

ning roll, which was simply an enlarged cake or pie crust cutter with a larger wheel. The ordinary size of spinning wheel ran from one and a half to two and a half inches, and the edge went down to a sharp cutting edge just blunted over by spinning against an oil stone. This was a metal roll or wheel. The wheel was held between two supports in the shape of a yoke and a wooden handle attached. The ordinary method of operation for using this roll or spinning tool on the fabric and core for applying was to unclamp the set screw on the bench and turn the core and spider from a vertical to approximately a forty-five degree position, then to clamp the supporting arm so as to hold the core and spider in that position. The pawl was then released from the hub so that the core and spider could revolve on the support, and with the handle previously mentioned as attached to one of the arms of the spider, the core was revolved rapidly. Because of its weight, approximately one hundred and fifty to two hundred and fifty pounds, it would maintain its speed of revolution for some considerable time. While it was revolving the operator would take the spinning tool in his hand and apply it to the revolving core and fabric at the end of the point of contact caused by the stretching, allowing it to revolve against the fabric and core with manual pressure applied. He would then gradually move it down, as the core and fabric revolved, in a radial line, towards the cutting point of the core, until the fabric was completely applied to the entire surface of the core on one side. The operator would then shift the position of his core and spider to approximately forty-five degrees on the opposite side of the vertical position and with his spinning tool apply the opposite side or skirt of the fabric in the same manner. While it was ordinary practice to spin down one side at a time, I have seen workmen spin it in a vertical position using a roller in each hand to save time. But as I say, it was not ordinary because very tiring.

The following plies of fabric were applied in the same way until the proper thickness of tire carcass was built up.

Q. 7. When you say the workmen would occasionally use a roller in each hand, do you mean that they would lay down both sides of the fabric at the same time?

A. Yes.

Q. 8. Are you positive that this operation you have described was followed at the Hood Co. prior to 1908?

A. The method as described above of putting down one side at a time was used from 1906, by all our operators. The use of a roll in each hand was not at all ordinary. It was too hard on the men to use the two rollers throughout a days work.

Q. 9. What position did you hold in the Hood Rubber Co. in 1906 and 1907?

A. At that time I was manager of the experimental department, which made out all construction and operating orders for mill methods.

Q. 10. By the expression "mill methods" do you mean the methods followed in manufacturing the tires?

A. Yes.

Q. 11. Did you yourself see these tires made by the spinning method you have described in 1906 and 1907?

A. I not only saw it, but did it myself.

Q. 12. While the core with the fabric on it was rotating, as you have described, what position did the edges of the fabric take or maintain?

A. The fabric stood out at approximately right angles to the plane of the core. The roller was applied to the fabric on the core at approximately an angle of forty-five degrees to the plane of the core. As the operator moved the roller radially towards the cutting line the fabric moved from a position of right angles down towards the cutting line of the core to a position horizontal with the plane of the core and finally beyond that position to a

position approximately ten per cent the opposite side of the plane of the core.

Q. 13. Do you remember the suit of Seiberling v. Firestone involving a tire making machine?

A. Yes.

Q. 14. Did the Hood Co. sell to the Firestone Co. a tire making machine for that suit?

A. Yes.

Q. 15. Please state what that machine was?

A. It was the first original machine which the Hood Co. purchased from Mr. Mathern, installed the latter part of 1911, and in operation from then until the time of sale to the Firestone Co.

Q. 16. Did you know Mr. Mathern?

A. Yes.

Q. 17. Did you work with him or he with you?

A. He was in our plant installing the first machine approximately a month. On a later visit he was with us approximately ten days.

Q. 18. Can you tell us what sort of man he was?

A. He was a well educated, technically trained inventor and designer, with a very thorough knowledge of European tire making practice.

Q. 19. Are you an engineer, Mr. Duncan?

A. I hold the degree of Bachelor of Chemistry from Massachusetts Institute of Technology. The Chemical Course included the engineering practice embodied now in the course on Chemical Engineering.

Q. 20. And you are a graduate of Yale?

A. I am also a graduate of Yale.

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 21. How do you fix the dates that you have given, Mr. Duncan, by memory alone?

A. We started the tire business with the Hood

Rubber Co. approximately nine months after our experimental department was moved from Boston to the factory, which was on June 1, 1905. That is the date I find on the payroll cards of the Hood Rubber Co. That is to say, we started the manufacture of tires I referred to in April or the Spring of 1906.

x-Q. 22. In this suit of Seiberling *v.* Firestone, you executed one or more affidavits, did you not?

A. Yes.

x-Q. 23. And when did you last see or read over those affidavits or a copy of one or more of them?

A. This morning.

x-Q. 24. And did you refer at any time during your direct examination to that copy of affidavit?

A. I referred for dates.

x-Q. 25. Is the paper lying before you on the table that affidavit or a copy of it?

A. It is a copy of it.

x-Q. 26. I understand that in this hand spinning operation that you have described the amount of circumferential stretch was twelve per cent. Is that correct?

A. We have made tires with stretch from eight to twenty-four. I used twelve because it is about as much as the ordinary hand worker will pull. This might vary on an actual hand made tire as high as seventeen percent.

x-Q. 27. What did you say was the average stretch employed in connection with hand made tires such as you have already referred to?

A. This will vary with different companies. We preferred to get seventeen.

x-Q. 28. Why did you prefer to get seventeen percent of stretch?

A. Because that brought what we called the neutral line of fabric to the best position on the side of the tire which could be obtained with manual stretching.

x-Q. 29. Why did you call this position the "best" position?

A. When the fabric is cut to a length and width for application to the core, it is cut on the bias, and the warp and filler lines are at forty-five degrees angles to the length of the strip, or a ninety degree angle to each other.

In order to apply such a flat strip to the entire surface of the core, it is necessary to make the length of the strip at about a medium circumference of the core.

As it is stretched on at the top of the core, the warp and filler yarns naturally change from a ninety degree angle to each other to a smaller angle relative to the top circumference of the core. As the fabric is applied down over the side of the core toward the smaller circumference at the cutting line, there comes a point on the side of the core where the warp and filler lines are at again a ninety degree angle to each other. From that point to the cutting line, the angle is again changed to a greater than ninety degree difference relative to the circumferential line. The road service shows that the nearer this neutral line, or the point at which the warp and filler threads remain at a ninety degree angle, is to the bead seat position of the rim on the tire, the better the tire will run. A seventeen per cent stretch brought this line down toward the cutting line of the core about as far as could be obtained by manual stretching.

x-Q. 30. I suppose also that the further you stretched the fabric down onto the core, by the original circumferential stretching, the less was the amount necessary to be formed down to the cutting line by hand. Is that correct?

A. That would naturally have to follow.

x-Q. 31. After the spinning operation that you have described, was there any further manipulation of the ply before you superposed the next ply?

A. Nothing except to trim off the excess fabric extending beyond the cutting line and placing the core back again in a vertical position for the start of the next ply application.

x-Q. 32. Were these hand made tires straight side or clinchers?

A. They were in 1906 at least clincher and quick-detachable clincher. In 1907 we manufactured the Dunlop type of straight side.

x-Q. 33. I understand from your testimony that the method of hand spinning you have described was the only method employed in the hand making of tires by the Hood Co. Is that correct?

A. That was the way we told all our operators.

x-Q. 34. Was any other method ever used by the Hood Co. in making the tires by hand.

A. Not to my knowledge.

x-Q. 35. You are familiar with the so-called saw-tooth method of stretching tires are you not? As illustrated for instance in the sketch I am showing you which is Plaintiff's Exhibit No. 7.

A. Do you mean the movement of the stitching and spinning tool back and forth or do you mean the shoving of what is called a spade tool right down to the end?

x-Q. 36. I should like to get your knowledge as to either or both of the methods you mention.

A. The only time that a saw-tooth movement of a stitcher or a spading tool need be used is when a wrinkle develops in the application by the spinning roll in the hand spinning which necessitates lifting the fabric from the core and straightening out the wrinkle. With a skilled operator who did not move his spinning tool too rapidly toward the cutting line in the radial line of the core, the necessity for the use of a saw-tooth movement or the spade for straightening out a wrinkle never developed. If the operator moved the tool too rapidly, he might develop one or two wrinkles which would be removed by the saw-tooth or the spade.

x-Q. 37. And when such a wrinkle or defect as you describe occurred, it was the Hood practice to remove

the defect or wrinkle by the use of the tool in the manner referred to by you in your last answer. Is that correct?

A. In such cases, which were very seldom, we always used the spade, in substantially a radial direction at the place where the wrinkle occurred to eradicate it.

x-Q. 38. Did it ever happen that the initial momentum given the core in rotating it was not sufficient to keep the core rotating until the spinning operation was complete?

A. It may have. If it did, it was started again.

x-Q. 39. And when it was started again, did the operator begin the spinning operation at the point where he left off before, or did he begin the spinning operation all over again?

A. He would begin a little above his finishing point.

x-Q. 40. You say that you practiced this hand spinning method yourself on occasion?

A. Yes.

x-Q. 41. Are you able to say what amount of pressure you employed to hold the stitcher against the core?

A. In determining the amount necessary to apply on machine rollers, we found that tests on the hand pressure as near as we could develop amounted to about a one hundred pound spring.

x-Q. 42. And that pressure was normally exerted by the workman in spinning down the side of the fabric on the core in the hand spinning operation?

A. I should say that it would vary from twenty-five to a hundred and fifty pounds according to how tired the man was.

x-Q. 43. In other words, the workman after a hard day's work, would be unable to exert the same amount of pressure on the side of the core as in the morning when he was fresh. Is that the idea?

A. It seems very probable.

x-Q. 44. And you think that the pressure would vary

according to circumstance from twenty-five to one hundred and fifty pounds?

A. That would be my idea.

x-Q. 45. How many tires a day would a man make by the hand spinning method you have described?

A. Where a man made a complete tire, outside covering and all, he would make from three to four small ones and from a half to one large one. When a man only applied the plies, I have never seen over eighteen small ones or five large ones, as a high record.

x-Q. 46. And ignoring the high record, what would be the average production of the workman where he laid down the plies without finishing the tire?

A. About twelve small ones and four large ones.

x-Q. 47. And you say that at the end of the day, he would be pretty thoroughly fatigued,—"all in", I think was the expression you used.

A. He would be tired, yes. I can answer that from personal experience.

x-Q. 48. Was there any tendency of the hand held roller to slip when on the side of the core, when great pressure was applied to it?

A. Not when a spinning wheel of about two and a half inches diameter was used. A small wheel would have a tendency to let the skirt of fabric catch the supporting yoke and jerk it out of position.

x-Q. 49. What size spinning wheels were ordinarily used by the Hood Co. in the hand spinning method?

A. The first wheels were about an inch in diameter but were almost immediately increased from two to two and a half inches.

x-Q. 50. And the smaller ones were abandoned?

A. The smaller ones were abandoned.

x-Q. 51. How did the operator hold the tool, I mean the spinning roll, during the hand spinning operation.

A. He held it out at the end of his arm, with the arm

crooked and with the roll at about a forty-five degree angle to the plane of the core, and then moved the roll radially inward.

x-Q. 52. Was that the only method employed by the Hood workmen of holding the hand spinning tool,—I mean the one described by you in your last answer.

A. That was the method taught the operator. Sometimes a light man would put his other hand on top of the hand holding the tool.

x-Q. 53. Then I understand you to say that with the tool held away from the body and with the arm crooked, the operator could continuously exert, or at any rate exert for some time, a pressure of one hundred and fifty pounds on the side of the core? Is that correct?

A. No, that would be the high pressure. It would vary from that down to about twenty-five pounds.

x-Q. 54. In other words, when he started fresh in the morning, he would be exerting a pressure of 150 pounds but by night the pressure might diminish to 25 pounds. Is that the idea?

A. That would vary with the man. He might exert the greatest pressure in the middle of the day.

x-Q. 55. Would you say that in two successive operations, the first on one side of the core, and the second on the other side of the core, that the amount of pressure would be uniform?

A. I should say very unlikely, but it is immaterial, providing the fabric is applied smoothly.

x-Q. 56. In other words, do you regard the amount of pressure on the core as immaterial, so long as the fabric is applied thereby smoothly to the core?

A. Yes. The important thing is the stretch.

x-Q. 57. You mean radial stretch, do you not by your last reference to the stretch?

A. I mean circumferential stretch because that governs radial stretch.

x-Q. 58. Then if I understand you correctly, you regard the circumferential stretch applied initially as the important thing, and the amount of side pressure subsequently applied as relatively unimportant.

A. Yes, the amount of side pressure need be only sufficient to apply the fabric smoothly. The adhesion is obtained during the molding operation.

x-Q. 59. What was the weight of fabric used in making tires by this hand spinning operation?

A. It was seventeen and a quarter ounce standard Hood tire fabric, approximately twenty-three threads to the inch in each direction, of 23/11 yarn.

x-Q. 60. In other words you then used about the same kind of fabric that you now use?

A. The specifications were practically identical.

x-Q. 61. How long did this hand spinning operation continue in use in the Hood plant?

A. Until the installation of the Mathern machines in 1911 and 1912, and up to the present time on the five and a half inch tires, which was discontinued in the summer of 1918 by the War Industry Board.

x-Q. 62. Was there any difference in product due to the personal equation of the workman or because of his possible vagaries or lack of attention, or anything of that sort?

A. We did not notice any. We had a good inspection system.

x-Q. 63. Now Mr. Duncan, I understand that when you adopted the Mathern machine in the year 1910 and 1911, that Mathern machine was not provided with a tool like that illustrated in Fig. 6 of the Mathern-Belgian patent.

A. No.

xQ. 64. But the Mathern machine was provided with the means shown and described in the Mathern German

patent for laying down the skirts upon the inwardly turned sides of the core. Is that correct?

A. Referring to the Mathern German patent, it had the spinning rollers shown in Fig. 1, at 29.

x-Q. 65. And it also had the pair of reciprocating rollers 30 shown both in his Belgian and German patents?

A. It had a single pair of such rollers for the smaller machines, I mean for the smaller cores, while additional pairs of similar rollers were provided for use with the larger cores for the manufacture of the larger size tires.

x-Q. 66. Please tell me how the pairs of reciprocating rollers 30 last referred to operated on the fabric already stretched on the core?

A. They were used to apply the fabric down to the neutral line of the fabric, approximately the center of the side of the core.

x-Q. 67. And after that, the stepped rolls 29 of the German patent were employed to attach the skirts of the fabric for the remainder of the distance to the bead. Is that correct?

A. That is true. We had the rollers shown in the Belgian patent discarded from the machine, because that necessitated putting on each ply separately and then screwing down the carriage holding the yoke and a pair of rollers. By the use of the series of stepped rollers we were able to make the carcass in one complete operation without cutting at each ply, which insured absolutely uniform stretch. The machine was offered to us with either device but this latter looked better to us from a standpoint of uniform stretch and speed.

x-Q. 68. Then I understand that in the use of these Mathern machines you also relied upon a considerable percentage of circumferential stretch. Is that correct?

A. Yes, we run from seventeen to twenty-four percent depending upon the size of the tire.

x-Q. 69. And in that way you succeed in getting the line of attachment of the ply to the core further down than if you used a smaller percentage of stretch.

A. Yes, it goes nearer the cutting line.

x-Q. 70. And that in turn, as you have already indicated, proportionately reduces the amount of side forming of the unattached skirt. Is that correct?

A. A very slight amount.

x-Q. 71. And I understand also that in these Mathern machines your main idea is to attach the skirts of the fabric to the sides of the core smoothly, rather than with the intention of stretching them radially. Is that correct?

A. Partially. We aim to apply it smoothly with a proper angle of the warp and filler yarns to each other.

x-Q. 72. And you still use the set of side forming rolls for instance as shown at 29 in Fig 1 of the Mathern German patent.

A. Yes.

x-Q. 73. And those rolls move in a circumferential path without radial component?

A. We use some moving in a circumferential path and some stationary. It seems to be immaterial. Each pair of rolls takes the place of a radial movement of a single pair of rolls.

x-Q. 74. But none of the rolls that you now use move in a radial direction?

A. Not during the revolution of the core. They are moved radially for different sized cores and a radial movement is unnecessary because each pair of rolls takes care of the next successive step down of the radial movement.

x-Q. 75. In other words, the radial movement you refer to is one availed of only when you change the size of the core.

A. Yes.

x-Q. 76. And there is no radial movement of any of the rolls during the actual formation of the sides of the tire?

A. There is no radial movement of the rolls. There is radial movement of the fabric, due to the application position of the rolls.

x-Q. 77. Then the stretching effect, if there be any, is due to the oblique setting of the radially stationary roll, and not to any radial movement of the roll itself?

A. That is correct.

Cross-examination closed.

REDIRECT-EXAMINATION:

Rd-Q. 78. What position do you hold at present in the Hood Rubber Co., in addition to your position as president of the Hood Tire Co.?

A. I am manager of the tire department of the Hood Rubber Co.

Deposition closed.

Signature waived.

Notarial certificate waived.

UNITED STATES DISTRICT COURT

DISTRICT OF NEW JERSEY

FRANK A. SEIBERLING,
Plaintiff,

AGAINST

THE JOHN E. THROPP'S SONS COMPANY,
Defendant.

In Equity
No. 614

Defendant's Testimony.

Testimony taken in behalf of defendant, pursuant to notice and agreement of counsel, before F. GEORGE BARRY, a Notary Public in and for the County of Westchester, State of New York, (certificate filed in New York County), at the offices of Brown & Seward, 261 Broadway, New York, N. Y., beginning on Friday, June 13, 1919, at 11 A. M.

APPEARANCES:

ROBERT FLETCHER ROGERS, Esq., and LUTHER E. MORRISON, Esq., for the Plaintiff;

E. CLARKSON SEWARD, Esq., for the Defendant.

PAUL J. SALVATORE, a witness called on behalf of defendant, being duly sworn, testifies as follows:

DIRECT-EXAMINATION BY MR. SEWARD:

Q. 1. State your name, residence and occupation?

A. Paul J. Salvatore, Hoboken, New Jersey; in charge of the French Courses at Stevens Institute of Technology, Hoboken, New Jersey.

Q. 3. State your education and training in the French language?

A. Bachelor of Arts from Columbia with honors in French and Spanish, completed the courses for the Master's degree with major subjects, French and Spanish, Assistant to Professor C. Fontaine in editing French readers for High School and College use.

Q. 4. Have you translated the Belgian Patent to Alphonse Mathern, No. 194731, dated Septetmber 20, 1906, from the French Language into the English language?

A. Yes, I have.

Q. 5. Will you produce that translation together with the actual copy of the patent you translated?

A. Here it is.

Mr. Seward: I offer in evidence the copy of patent produced by the witness which is a certified copy of the said patent now on file in the United States Circuit Court of Appeals for the Sixth Circuit; together with the translation produced by the witness, and ask that the two be marked as one exhibit, "Defendant's Exhibit F. Mathern Belgian patent."

Direct-examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 6. Professor Salvatore, will you kindly give me the French equivalent for the English word "wrinkle", as applied to stuffs or fabrics?

A. I could use the word *"pli"*, the plural being *"plis"*.

x-Q. 7. In that event I take it, the word corresponding to the English verb "to unwrinkle" would be *"déplisser"*?

A. I wouldn't very well agree with that, because the dictionaries I have used give no such translation of "unwrinkle",

Q. 2. How long have you taught French at Stevens?

A. Over three years.

x-Q. 8. I am not asking you what the translation of any French word is. I am asking if the French word corresponding to the English "wrinkle" be "pli", how would you translate the English word "to unwrinkle" into French?

A. I would translate the word "to unwrinkle" by the French word "déplier".

x-Q. 9. And you do not think that the word "déplisser" is properly to be translated into English as "to unwrinkle" in any circumstances?

A. No, sir.

x-Q. 10. And I take it you would hold the same conclusion with respect to the words "déplissage" and "déplissement", namely, that these words do not properly represent the English words "unwrinkling", etc.?

A. I would.

x-Q. 11. Are you of French descent, Professor Salvatore?

A. No. I am of Italian descent.

Cross-examination closed.

Deposition closed.

Signature waived.

Certificate waived.

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Plaintiff,

AGAINST

THE JOHN E. THROPP'S SONS COMPANY,
Defendant.

In Equity
No. 614

Defendant's Testimony.

Testimony taken in behalf of defendant, pursuant to Notice and Agreement of Counsel, before F. GEORGE BARRY, a Notary Public in and for the County of Westchester, State of New York (Certificate filed in County of New York, State of New York) at the office of Brown and Seward, 261 Broadway, New York, N. Y., on June 12, 1919, beginning at 11 A. M.

APPEARANCES.

ROBERT FLETCHER ROGERS, Esq., and LUTHER E. MORRISON, Esq. for Plaintiff;

E. CLARKSON SEWARD, Esq., for defendant.

FRANK N. WATERMAN, a witness called on behalf of defendant, being duly sworn, testifies as follows:

DIRECT-EXAMINATION BY MR. SEWARD:

Q. 1. Please state your name, residence and occupation?

A. Frank N. Waterman, Summit, New Jersey, Consulting Engineer.

Q. 2. Please state your training and experience, briefly, which qualify you to testify as an expert in this case?

A. I graduated from Cornell University in 1889 as Mechanical Engineer and since that time I have been continuously practising in that capacity. For a number of years I was engaged in the design, testing and installation of steam and electrical machinery of various sorts. Since that time I have been acting as an engineer with an office in New York City. I have frequently had occasion to visit tire factories and to examine the various processes and machines involved in the manufacture of bicycle and automobile tires. I have frequently been called upon to act as an expert in litgations involving patents and to give opinions as to the value and operativeness of machines and processes set forth in patents.

Q. 3. Will you give the names and subject matters of some of the patent suits relating to tires in which you have testified as an expert?

A. I do not remember the names of the parties involved in the cases. I testified as expert in a case involving the fundamental patents for the Dunlop detachable tire, and one involving the removable inner tube and one involving the non skid tread, and several involving the appliances used in the manufacture of automobile tires, the latter including the case of *Goodyear* v. *Ajax*, relating to a collapsible core for the manufacture of tires; the case of *deLaski and Thropp Circular Woven Tire Co.* v. *William R. Thropp & Sons Co.*, involving a machine for wrapping tires and molds for vulcanization; the cases of the last named plaintiff against the *Empire Company*, and the *Miller Company*, also involving the tire wrapping machines; the case of the same plaintiff against the *United States Tire Company*, involving molds for holding tires during vulcanization.

Q. 4. Have you read and do you understand the State

patent in suit, and have you read the testimony of Plaintiff's experts Browne and Ray?

A. Yes.

Q. 5. Will you please describe the construction and operation of the machine disclosed in said patent, referring at any time, if you desire, to the testimony of Plaintiff's experts.

A. The State patent relates to a machine for manufacturing the shoe or outer casing of an automobile tire. It is in its nature an assemblage of tools which the workman may successively apply, rather than an automatic machine. The general arrangement or grouping of parts is best seen in Fig. 1, from which it will be observed that the machine is double, being in effect two machines in one so that two operators may simultaneously build two tires. To this end, it consists of a fabric supply stand 2 arranged to hold four rolls of fabric of two different widths and of mechanism mounted on a base 1 for driving cores upon which the tires are to be built. The general arrangement of the machine is clearly seen in Fig. 1. A driving motor 49 supplies power to a shaft 53 which in turn communicates it to machine elements at each end of the machine by chain drives such as 55, 56. This power is supplied through a clutch 57, 59 to the shafts on which the cores, such as 115, are mounted, and intermediate mechanism is provided to rotate the core 115 at one or the other of two speeds. The mechanism to which I have been referring is most clearly seen in detail in Fig. 5.

For the purpose of further description, it will be sufficient to refer to one end of the machine only since the two are duplicates and, in general, one end is all that is shown in the several figures, other than Figs. 1 and 5.

Looking at Fig. 2, the core 115 is shown mounted between an assemblage of supply rolls on the left and an assemblage of operating tools on the right. The supply rolls are mounted upon a base 3 serving as a

support for a turn table 8. A turn table 131 carrying the operating tools is mounted on the base 118.

The tire is built up of superposed layers of the fabric separately stretched upon the core, exactly in accordance with the usual hand methods of making such tires. In Fig. 2, the fabric is shown drawn from a supply roll at 25, the canvas being led from the supply roll under an idle roller 30, over a tension roll 41 and thence onto the core where it is shown in the position for starting the operation. The function of the core driving mechanism previously referred to is to rotate the core while the canvas is being applied, and to this end it is described as provided with low and high speed gear arrangements. In the condition shown in Fig. 2, the workmen would engage the low speed drive to revolve the core 115 slowly, thereby drawing the fabric from the supply and stretching it at the same time. A tension mechanism is provided for the tension roll 36, which is seen at the left of Fig. 2 at 42, 43 and more in detail in Fig. 7 on the same sheet. The purpose of revolving the core by power is to relieve the workmen of the physical strain of stretching the fabric, thereby getting a more uniform stretch. In this stretching operation, the patentee states that the fabric tends to develop troublesome wrinkles which must be gotten rid of and, in an attempt to get rid of such wrinkles, the roller 41 is provided with coarse spiral grooves or screw threads leading in opposite directions from the center of the roller.

After sufficient fabric has thus been drawn from the supply roll to reach once around the core, the machine is stopped and the fabric cut off by hand. The machine is thus not in any sense automatic but is only a convenient support for the several instrumentalities required. The purpose of having several rolls of supply fabric and of having different widths of fabric is that there should be conveniently at hand fabrics of the different widths re-

quired for different layers, and these are made accessible by rotating the turn table 8, and holding it in any position by the lugs 13 which may be engaged by a catch 14.

The several tools which a workmen, in building a tire by hand, would use to lay the fabric down upon the core, are conveniently grouped on the turn table 131, and by turning this turntable (or turret head as the specification calls it) to any desired position, the workman at will brings into use the tool desired. This arrangement of tools on the turn table or turret head, may be seen by referring to Figs. 2 and 9. Thus the tread roller, for rolling the fabric into contact with the tread portion of the core is seen at 141 and it may be moved to and from the core by turning the hand wheel 124, this being turned at pleasure by the workman and not in any automatic way by the machine. When he is through using the tread roll, the workman can bring into play any other tool, as for example the spinning wheels 147 shown in Fig. 9, for smoothing the fabric down along the remainder of the surface of the core. This roll 147 is the ordinary spinning roll or stitcher of the hand building of tires. It is mounted on a lever and pressed laterally toward the central plane of the core by a spring 145, there being however, a handle 142 by which the workman moves the spinning roll at will laterally toward or from the core surface. By turning the hand wheel 124, this spinning roll is moved radially toward or from the center of the core. Thus by simultaneously operating the hand wheel 124 and the handle 142, the operator performs the smoothing down of the fabric against the core, just as was usual in the hand building of tires. Two spinning rolls 147 identically mounted are provided, one to operate on each side of the tire; so that the workman may at will use first one and then the other or both simultaneously.

This same turret head supports other tire making tools, as for example 154 to 156 indicate the elements of a bead placing mechanism, which I understand it is un-

necessary here to describe in detail. Also 149 shows cutting knives arranged to trim off any excess fabric at the inner edge of the core after the plies of fabric are laid in place.

Thus this turret is a sort of revoluble table upon which the tools which the workman is to use are arranged convenient to his hand.

For mounting the core, a suitable chuck 101 having "centers" 106 is provided. This enables the workman to conveniently dismount the core after the fabrics have been formed upon it and replace it by another core of the same or different size upon which to build another tire shoe. Should he attach a core of another size, the support 118 for the turret may be moved toward or from the core by the screw 121, as seen at the base of the machine in Fig. 2.

The position of the fabric rolls with reference to the core is, however, not adjustable but will vary as the size of tire to be built varies, being fixed far enough away for the largest tire. The fabric rolls are readily removable and may be interchanged when tires of different size are to be built.

Referring now more in detail to the power driving mechanism, by specific reference to Figs. 3, 4 and 5, the core is mounted upon a shaft 90, which shaft may be caused to rotate, or may be held rigid by means of a stop arrangement 93, 95, 97 and 100 shown in Fig. 3. When this stop mechanism is released, the shaft 90, with the core attached to it, is free to revolve. As seen in Fig. 5, this shaft 90 carries a gear 89 meshing with the gear 88 on a shaft 70. The particular arrangement of this shaft is best seen in Figs. 3 and 4. In figure 3, the gear 88 is shown at the left. At the center of the shaft is an adjustable clutch member 71 which is keyed to the shaft, but is capable of sliding thereon to engage with either one or the other of two worm wheels, or spiral gears as the specification

calls them, 75 and 83, which bear corresponding clutch members 72 and 73. These worm wheels and their clutch members are free on the shaft except when the slidable clutch member 71 is engaged with one or the other of them.

If, for instance, the clutch member 71 is moved to the left (as seen in Fig. 3) to engage clutch member 72, then the worm wheel 75 is made fast to the shaft 70 and that shaft will rotate at the speed at which wheel 75 is driven. If on the other hand, the clutch member 71 is slid to the right and engages the other clutch member 73, then the gear 83 is fast to the shaft, while 75 is free upon it. The shaft 70 must then rotate at the speed at which the worm wheel 83 is driven.

The specification states that the worm wheels 75 and 83 are driven in like manner, each by a worm meshing with the worm wheel. The specific arrangement is shown in Fig. 4, where the worm wheel 75 is shown as driven by the worm 76 mounted on the shaft 58, and the specification states (page 3, lines 123-129) that the wheel 83 is driven by a worm 82 on the shaft 78.

The statements of the specification are conflicting as to which of these worm gear arrangements provides the high speed and there is no consistent description contained in the specification to enable one to understand what the mechanism is by which the particular speeds mentioned are to be attained.

Looking for a moment at Fig. 5, it will be seen that the driving power from the motor 49 is transmitted by a chain 51 and shaft 53 to chain 56 which drives one member of a friction clutch 57. The other member 59 of this clutch is controlled at the will of the workman by a clutch shifter 59′. (See also Fig. 1.) The shaft 58 is actuated when the clutch members are engaged and it is this shaft 58 which is seen in Fig. 4 driving the worm 76. If we assume that the shaft 58 is driven by the motor at a speed of 135 R.P.M. and also assume that the worm

wheel 75 has forty-five teeth, then the wheel 75 and the shaft 70 will revolve at 3 R.P.M., and the shaft 90 carrying the tire core will revolve at 6 R.P.M. 6 R.P.M. is the speed which the specification, page 2, line 3, describes as the proper slow speed for the shaft 90 and this shaft 90 revolves twice as fast as the shaft 70, because of the gear arrangement 88, 89, seen in Fig. 5, where a ratio of substantially 2:1 is indicated.

If the shaft 58 furnishes the slow speed drive, as is understood by Mr. Browne, plaintiff's expert, then the shaft 78 must furnish the high speed drive. On the face of the drawings, however, this is impossible, because the shaft 78 is driven by the chain 80 operating on sprocket wheels having a 3:2 ratio. Thus Mr. Browne's "high speed" driving shaft 78 in fact makes only 2 revolutions, while his "low speed" driving shaft 58 is making 3, or in other words, the shaft 78 rotates at 2/3 the speed of the shaft 58. Thus if the shaft 58 makes 135 revolutions per minute, as it must to provide the required low speed, then his "high speed" shaft 78 would make 90 R.P.M.

The gears 75 and 83 are shown as of the same diameter and so far as the drawings are concerned are exactly alike. The specification contains the following statement (see page 3, line 123):

> "The clutch member 72 is provided with a hub 74 rigidly secured to a spiral gear 75 adapted to be driven by means of a worm 76 mounted on the shaft 58 just as the corresponding clutch member 73 has a hub 84 secured to a spiral pinion 83 driven by a worm 82 on a shaft 78. The shaft 78 is driven from the shaft 58 by a chain and sprocket connection and the arrangement is such that the spiral gear 83 rotates much more rapidly than the spiral gear 75."

This statement just quoted says one gear is driven "just as" the other but says that by means of the chain

and sprocket connection "the arrangement is such that the spiral gear 83 rotates much more rapidly than the spiral gear 75". In the drawings, however, the sprocket and chain drive the shaft 78 at a slower instead of a faster speed so that if the shaft 58 rotates 135 revolutions, the shaft 78 would rotate only 90.

The high speed of the machine is stated on page 2, line 8, as 207 turns a minute. If the worm and wheel arrangement for the wheel 83 is "just as" that for wheel 75, then, in order to drive the core at a speed of 207 R.P.M., the shaft 70 must rotate at 103½ revolutions and the shaft 78 at 4657 R.P.M. But if the low speed is correct, the shaft 78 will only rotate 90 R.P.M., which is only about 2 per cent of the necessary speed. Further, a speed of 4657 revolutions is utterly impracticable.

Thus, if we assume that the wheel 75 furnishes the low speed drive, we have a perfectly practicable speed for all of the parts, but the assumed high speed becomes a lower speed and only 4 R.P.M. instead of 207. If, on the other hand, we start with the assumption that the gear 83 is the high speed drive and drives the core at 207 as stated in the patent, then we arrive at an utterly impracticable speed for the shaft 78 and a still more impracticable high speed for the shaft 58.

If we assume that the gear 83 is a low speed drive and figure back, we find that (still assuming 6 R.P.M. as the low speed) the shaft 78 will have a perfectly practicable speed but the high speed drive will then only be 9 R.P.M., while the specification demands 207.

Thus it appears that the mechanism as described is not consistent with and is incapable of furnishing the two operating speeds which the specification also describes and the only two speeds which it mentions.

As I understand the testimony of Mr. Browne, plaintiff's expert, the particular high speed mentioned is unimportant, but it is essential that to effect the operation,

which he understands the patentee intends to disclose, the high speed should be more than 50 R.P.M., since, as he has observed, the peculiar operative effects he ascribes to the machine only begin to take place at about that speed. To obtain them in a useful degree I understand him to be of the opinion that the high speed must be considerably higher, as for example 80 to 120 R.P.M. On Mr. Browne's selection of the gear 75 as the low speed gear, the so-called high speed would only be 4 R.P.M., whereas if we assume that Mr. Browne is mistaken and that the gear 83 is the low speed gear, then the high speed would only be 9 R.P.M. So far as it is possible to apply the description of the drawings, therefore, there is no disclosure of any mechanism which can realize or even approximate the speed which Mr. Browne finds necessary to obtain even the beginning of the mode of operation

To get over this obvious difficulty, Mr. Browne assumes that the worm drives 75, 76 and 82, 83 are *not* one "just as" the other as the patent says, but that all the patent means to imply is that both are worm gear drives. The worm gear drive in typical form is one in which the worm rotates very much faster than the wheel; for example, in Fig. 4, the worm 76 rotates 46 times while the wheel 75 rotates once. If the wheel 83 is to be the high speed drive and to realize the speed set forth in the specification (207 R.P.M. for the shaft 90), then obviously the drive 83 must rotate 103½ times while the shaft 78 rotates only 90 times. In other words, the worm gear mechanism must actually have an *increasing* ratio instead of the usual greatly decreasing ratio.

It is my opinion that no such arrangement could have been intended by the patentee and, so far as I know, it is impracticable. My opinion is that, assuming the same size blanks, as the drawings clearly show and the specification clearly implies, it would be impracticable to get a ratio of speeds of the wheel 83 to drive the shaft 78

better than about 5:1 if the gears are to be proportioned to transmit the same amount of power. Of course gears of a lower ratio could be made if higher speeds could be employed or if lower power and freedom from shock would suffice. The specification, however, fixes the speed at 207, and under the conditions named it is my opinion that a ratio of 1:5 is the best that could be obtained. This would mean that the wheel 83 makes one revolution, while the shaft 78 makes 5 revolutions.

If therefore, we accept Mr. Browne's conclusion that the difference of speed is to be obtained by giving different ratios to the gearing, then in my opinion the highest speed that would practically be obtained would be about 18 R.P.M. for the wheel 83, the latter making one revolution for every five of the shaft 78. This, however, would make a maximum speed of the shaft 90 and tire core of only 36 revolutions per minute, which is less than ¾ of the speed at which, according to Mr. Browne, the essential operation of the machine just begins.

The reason why the worm and wheel combination 82, 83 could in my opinion not be constructed for a ratio higher than about 1:5, is that it would not seem possible to get on blanks of the relative size of those indicated in the drawing (and of the actual size that I would understand would be used in practice) the required tooth dimensions to stand the shock strains. Of course on paper it is easy enough to draw lines indicating a certain number of teeth and certain tooth angles which, if they could be built, would run at the required ratio if they had no work to do. Machines, however, are built to do work and to withstand certain shocks and strains, and gearing combinations, as well as all other parts, are designed by starting with the permissible dimensions and strains as a basis. The difficulty in designing a worm gear for such abnormal speed ratio as would here be required, is that it is difficult or impossible to get a sufficient "root thick-

ness" for the teeth, and at the same time have such a number of teeth as is required for the speed ratio and to transmit the shocks at the actual required speeds.

I have not actually laid out the gears or made the calculations to determine what would be the minimum ratio that might be obtained, because to do this would be a very long and tedious operation requiring a great mass of calculations and in the nature of a "cut and try" process, and the minimum might easily depend upon some particular ingenious combination of tooth numbers and angles. I am satisfied, however, that for the speeds proposed, the same horse power transmitted, and with the general dimensions that I understand would apply, the ratio of 5:1, which I have given is not very far from the correct one, as the limit, and if forty-five teeth is to be regarded as fixed for the gear 83, then I would be still more positive in my statement that a better ratio could not be expected.

I do not desire to be understood as saying that in machine illustration in general or when usual gear combinations are indicated it is necessary that the drawings should show the specific details of the gearing as to the number of teeth and the like, but in this instance a most unusual and extraordinary ratio seems to be required, a ratio so far as I know which has never been attained by worm gearing. Such a problem is not one for the ordinary mechanic and is one which, if solvable at all, is only solvable by virtue of the skill and ingenuity of some gear specialist.

In this connection, I call attention to the fact that from Figs. 1, 3 and 4 a definite understanding of the worm gear combination 75, 76 can be obtained, but neither of these figures nor any others give any idea as to the combination 82, 83, except Fig. 3. Fig. 3 only shows the gears 75 and 83 and these only in cross section. Looking

at the upper parts of these cross sectional figures of gears 75 and 83, it will be seen a full tooth is shown in each. But this indicates that each is the usual worm wheel of small tooth lead.

Adjourned to Friday, June 13, 1919, at 10.30 A. M.

NEW YORK, June 13, 1919, 11.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

EXAMINATION OF MR. WATERMAN Continued:

To obtain, however, any such ratio as would be necessary to realize a speed of 207 revolutions, or even the 50 revolutions at which the essential action described in this machine is alleged to begin, would require such a lead of the teeth that more than one tooth would show in the cross sectional illustration of the gear 83 in Fig. 3. It is therefore clear that whoever made the drawings had no intention of illustrating a gear of the abnormal proportions which would be required to realize Mr. Brown's suggested construction.

The supposed mode of operation of the machine is indicated in Figs. 12 to 12C. At page 2, line 43, the specification says "Figs. 12, 12*a*, 12*b*, 12*c* are cross sections of a ring-core for inextensible edge tires with the fabric in different stages of application;" Again at page 6, line 65, it says, "To this end I use a collapsible ring-core, the shape of which in cross section is shown in Figs. 12, 12*a*, 12*b* and 12*c*. The fabric in the several stages of application is also shown in these figures."

Again, at page 7, line 6, it is said:

> "At first the spinning rolls are positioned to act upon the edges of the tread portion of the tire-shoe. But they are gradually moved radially by the oper-

ator by operating the hand-wheel 124 so that they pass over the side portions of the tire-shoe as illustrated in Figs. 12*a*, 12*b* and Fig. 9."

As Fig. 12*a* does not show these rollers at all, it is possible that the reference to 12*a* and 12*b* should read 12*b* and 12*c*. Such a change would make this reference intelligible where as it stands it is not.

I have quoted these statements, which are all I find, because these drawings seem to indicate a mode of operation of the machine different from that understood by Mr. Brown, namely, the ordinary hand tire-making process, notwithstanding the fact that the tools provided are the same.

Thus in Fig. 12 the fabric is shown as just touching the outermost portion of the core 136. In the ordinary hand process, as I have seen it and as I understand it is universally employed the fabric and core never assume this relation.

In the hand method of tire-making the fabric is applied by attaching one end to the core after coating the latter with cement and is then violently stretched by the workman as it is laid on. This stretching occurs chiefly along the middle of the fabric and has the effect therefore of curving it so as to shape it to the form of the core over the tread portion or even farther down along the sides of the core. The section of the core and fabric, as thus applied by a stretching process comparable to hand making of tires, would not look at all like Fig. 12 of the State patent. By comparing Fig. 12 and 12*a* it appears that the intended operation of the State machine is that the fabric should be first laid upon the core stretched somewhat but with a tension very much less than that employed in the hand process, as customarily practised, the tension not being sufficient to fully shape the fabric over the tread portion. It is then apparently

shaped by the application of the tread roller 141, where as in the hand process this roller is used merely to roll out air bubbles and cause close adhesion of the fabric to the cemented core.

In the further shaping of the fabric to the core in the hand process, various ways of working were used but a common way, as I understand, was to revolve the core at a comparatively high speed and then, with a spinning or stitching wheel like the wheel 147, pressed hard against the fabric, the latter was spun in place just as metal is commonly spun over a mold by a hand or machine supported spinning wheel. In doing this, however, the spinning wheel is pressed hard against the *core* so as to squeeze the fabric between the wheel and the core and not at all as in Figs. 12*b* and 12*c* of the patent where the spinning rolls 147 press against or into a fold of the fabric and do not squeeze the fabric against the core.

The patentee states at page 2, lines 4 to 11, that he has "discovered" that it is possible to use a very high speed of rotation. Thus he says,

> "I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at 207 turns a minute. By this means the machine not only does more work in a given time but it does better work."

At the high speed mentioned the centrifugal force would of course be very considerable since this force varies with the square of the speed. I understand that the theory of Mr. Brown the plaintiff's expert, is that this centrifugal force acts like invisible fingers pulling the fabric radially outward thus forming a loop of the fabric adjacent to the core.

Fig. 12*b* appears to support this view of Mr. Brown,

and shows the spinning rolls as lying and acting in the loop so formed instead of pressing the fabric strongly against the core as in the hand process. Fig 12c makes a similar showing and indicates that this same action of the spinning rolls (upon the fabric only instead of by squeezing the fabric against the core) is continued clear to the extreme inner boundary of the tire.

The foregoing appears to be the intended mode of operation and I find no other indicated by the drawings or specification. However, I call attention to the fact that the drawings disclose no mechanism by which the high speed necessary for this process could in fact be realized. The successive manipulations of the machine by the workmen, as set forth in the patent, are as follows. The tire core 115 having been put in place and coated with adhesive cement, the fabric is attached thereto at its end. The clutch member 71 is shifted to engage the low speed clutch member 72 and the clutch lever 59[1] (Figs. 1 and 5) actuated to cause the motor to drive the machine. Thereupon the core rotates at its slow speed and draws the fabric from the supply roll on to the core, under such an adjustment of the tension device as to produce the condition shown in Fig. 12. The rotation of the core is then stopped and the fabric cut off so that the ends properly lap and this operation of lapping the ends is performed by hand as is also the cutting. The clutch member 71 is then shifted by the workman so as to engage the supposed high speed clutch member 73 and the machine again set in rotation. The turret or turntable 131 is then revolved so as to bring the tread roller 141 into alignment with the core and by turning the wheel 124 the operator causes the tread roller to press and conform the fabric to the tire. I observe that this operation is the one which brings the fabric from the condition shown in Fig. 12 to that shown in Fig. 12*a*.

The operator then by a reverse movement of the wheel 124 draws the turret backward to remove the tread roller from the tire and turns it so as to bring into operative position the spinning roll 147 and, by proper operation of the wheel 124 while the handles 142 are manipulated by hand to hold the rollers apart, the latter are brought into position to operate upon the fabric. Precisely what position this would be does not appear from the patent. By further manipulation of the wheel 124 the spinning rolls are moved radially inward toward the centre of the core and the springs 145 tend to press the rollers towards the core while the centrifugal force tends to throw the fabric out and draw the rollers away from the core. On account of the high speed the specification states, page 6, line 36, *et seq.* that the centrifugal force tends to throw the fabric against the spinning wheels and the latter are therefore inclined at a receding angle so that the fabric will not become entangled. It is apparently this opposition of forces which results in lodging the spinning rolls 147 in the bites or folds of the fabric held out by the "invisible fingers" of the centrifugal force.. Successive layers are applied in a similar manner until the tire is ready for the application of the bead core. I do not understand that it is necessary for me to consider the appliances or mode of using them by which this operation is performed. Thereafter further layers of fabric are applied and the specification says that these "are applied to the ring core, precisely as in the case of the layers originally applied". This statement could be regarded as true only so far as application of the fabric down to bead cores is concerned as it is clear that the rolls 147 which are shown could not operate around these beads. It is apparent that any application of the fabric around the bottom of the beads could only be effected by some other tool such as a spinning roll held in the hands of the workman in accordance with the prior practice in the hand building of tires.

Q. 6. Does the patent in suit describe the amount of stretch or tension to be applied to the fabric in a circumferential direction while being drawn onto the core?

A. It does not. It merely refers to the tension as "the proper tension" and leaves the amount to be determined in view of the described operation as illustrated, for example, in Fig. 12.

Q. 7. Does the patent indicate anywhere that the fabric is stretched on with sufficient tension to cause it to adhere to the tread portion of the core?

A. By tread portion as used in the question I understand it is intended to designate the portion ordinarily indicated by that word, namely the outer third or more of the surface upon which the wear comes when the tire is in use.

The patent does not anywhere indicate that the fabric is so stretched as to cause it to be conformed to or to adhere to the tread portion of the core. The only light thrown on the matter is that afforded by Fig. 12 which shows that it is not so stretched and by the description and comparison of Figs. 12 and 12*a* which indicate that the action of the tread roller 141 is necessary to form the fabric to the core.

Q. 8. Does the patent suggest any means for shaping the fabric to the tread portion of the core except the tread roller 141?

A. It does not, and on the other hand, at several places in the specification the tread roller is described as acting to shape the tread portion of the fabric against the core. I refer for example to page 6, line 141, also line 122, also page 5, line 7.

Q. 9. Does the patent suggest that as a result of the operation of the machine there is any re-arrangement or any particular arrangement of the threads of the fabric due to circumferential stretch or radial stretch, or anything else?

A. It does not, nor am I able to find any statements from which any inferences on these matters may be drawn. The specification refers to the shaping of the fabric by the action of the tread roller and the spinning rolls, but whether this is by alteration of shape of the meshes of the fabric or by stretching or by compression of the fibers does not at all appear.

Q. 10. Does the patent suggest the use of any high speed rotation of the core other than approximately 207 R.P.M.?

A. It does not. The patentee sets forth the use of this high speed as a discovery of his own appearing to indicate something materially in excess of previously known speeds. The same indication is made by the special mode of operation apparently intended to be indicated by Figs. 12 to 12*c*.

Q. 11. Do you think that, with a speed of about 207 R.P.M. for the core and with the spinning rolls 147 pressed laterally by springs, as described, the method of operation indicated in Figs. 12*b* and 12*c* might take place?

A. Yes. Indeed, the position of parts as indicated in those figures, would apparently only result from the use of speeds substantially of the order stated as the high speed of the patent.

Q. 12. Is there anything in the patent which suggests that the benefits of any method of operation begin to be obtained at about a high speed of 50 R.P.M. and are fully obtained at a high speed of about 80 R.P.M. to 120 R.P.M.; or any suggestions of that nature?

A. There is not. It only refers to a speed "much higher than the low speed" and illustrates what is much higher by "say at 207 turns per minute" the low speed being given as 6. The selection of 207 turns rather than say 200 turns or 205 turns per minute seems to indicate some special significance as though perhaps 207 might

be a lower limit for the particular sort of operation discovered by the patentee.

Q. 13. Does the patent suggest the pressure to be exerted by the springs which press the spinning rolls laterally toward the core?

A. No, except to say (page 5, line 113, *et seq.*), that the springs exert the pressure which would be exerted by the hand of the workman using a hand tool for the same purposes. Of course, the pressure exerted by the workman with a hand tool is a pressure co-ordinated to much lower speeds, probably not more than half the speed stated by the patentee or thereabouts. It is perhaps through the use of this ordinary hand pressure and the excessive speed mentioned that the patentee made the particular discovery which he refers to and by virtue of which the peculiar operation of Figs. 12 to 12*c* is obtained. In other words, the high speed would result in a centrifugal force several times as great as would result from the more usual speeds and if only the force supplied by the workmen was used such excessive centrifugal force might lift the rollers away from the core as is clearly indicated in Figs. 12*b* and 12*c*.

Q. 14. Does the patent suggest that the use of the high rotative speed of the core is desirable in connection with the operation of the tread roller as well as in connection with the spinning roller?

A. Yes. For example, at page 6, line 120, *et seq.*, it is expressly stated that the fast speed mechanism is brought into play before the tread forming roll is used. For example, referring to Fig. 12*a* it will be seen that whereas in Fig. 12, which shows the low speed operation, the fabric is concaved inward. In Fig. 12*a* its exposed edges are concaved outward as a result of the high speed, and that the edges of the roll 141 seem to bear about the same relation to the fabric as will the later applied spinning rolls brought into use as illustrated for example

in Fig. 12*b*. It will be seen therefore that the patentee assumed the same co-operation between the high rotative speed and the tread roller as he assumes between that speed and the spinning rollers.

Q. 15. Does the patent show or describe any arrangement of springs which would impart a uniform lateral pressure to the spinning rolls 147 throughout their operation?

A. It does not. The pressure would obviously be greatest when the spinning rolls are most separated and would decrease as they approach one another in assuming the position shown for example in the upper part of Fig. 9.

Q. 16. Have you seen in operation certain tire making machines which purport to be the machines of the State patent?

A. Yes. I have seen a number of them and particularly at the Goodyear factory where a number of them were exhibited to me by plaintiff's counsel and expert Mr. Ray.

Q. 17. Will you state whether or not there were any important structural differences between those machines you saw at the Goodyear plant and the machine shown and described in the patent in suit; and if yes, point out some of the more important differences?

A. There were a number of differences which might be regarded as important.

The Stretching Roll. In the machine of the patent the stretching roll 36 is cylindrical, therefore not tending to stretch the centre of the fabric which goes onto the core in an unstretched condition as indicated in Fig. 12. In the machines exhibited to me the stretching roller was barrel shaped and tended to stretch the centre of the fabric, as was also the roller 41 which does the lateral stretching or smoothing. The fabric therefore did not go on the core as indicated in Fig. 12 of the patent but went

on just as in the hand building process, namely in a formed condition, the formation being produced by the central stretch. The tension on the tension roller was such as to produce this stretch and the convex form or barrel shape of this roller co-operated with this increased tension to pre-shape the fabric by stretching.

LATERAL STRETCHING ROLL. The lateral stretching roll 41 was in some cases convex and in others cylindrical but in no case did it prevent longitudinal creases, and the workman was compelled to remove them by taking hold of the fabric and vigorously stretching it laterally. This indicated that a forming by stretching was practiced in the machine, not described or contemplated in the patent.

CORE SPEEDS. I at once observed that the gears occupying positions as shown in Fig. 3 of the patent had opposite functions than those ascribed to them by Mr. Browne, namely, the gear in the position of the gear 83 was a worm wheel giving slow speed, this speed being 8 R.P.M. instead of 6 as stated in the patent. The worm and gear were normal in construction but appeared to have a ratio of 25 to 1 instead of 45 to 1 as Fig. 4 of the patent is interpreted by Mr. Browne.

The high speed was 120 R.P.M. instead of 207 and the gear mechanism which produced it occupied the position of the wheel and worm 75, 76 in Fig. 3, but were not a wheel and worm but on the contrary were a pair of spiral gears having a different ratio of diameters and a speed ratio of 1 to 1 instead of 45 to 1. It is evident therefore that this part of the machine has been completely redesigned as compared to the structure shown and described in the State patent in respect of these speed change mechanisms.

THE TREAD ROLLER. In the Goodyear machines exhibited to me the tread roller was not mounted on the

turret 131 but was separately mounted on the standard 118 and was operated by a foot treadle and I observed that the operator used it at the same time that he operated the spinning roll instead of successively as indicated in the patent.

THE SPINNING ROLL. The spinning rolls alone occupied the turret (there being no bead placing or cutting mechanisms mounted thereon). The mode of mounting of the arms carrying the spinning rolls was quite different from that shown in the patent, the arrangement being such that a single handle replaced the two handles 142. The machines shown me were not all alike, but the arrangement in each case was such that the spring played little or no part in the operation, the pressure being as I judged practically wholly applied by the operator leaning heavily against this handle while performing the spinning operation. In other words, the operator appeared to be making fully as much physical effort in this spinning operation as in the cases where I have seen the spinning operation performed by hand. The particular mechanism by which one handle replaced the two of the patent differed, but the leverage apparently did not differ materially and whether it was arranged to move in a horizontal plane as in one instance, or in a vertical plane as in another, the same considerable effort was exerted by the operator, apparently.

ACTION OF THE SPINNING ROLLS. The spinning rolls appeared relatively larger than is indicated in the State patent and they acted under the heavy pressure applied by the operator against the core as in ordinary hand spinning and there were no evidences of any invisible fingers pulling the fabric out and lifting these rolls from the core as indicated in Figs. 12*b* and 12*c*. In other words, these spinning rolls certainly did not act in bights or loops of

the unapplied fabric as indicated in these figures of the patent but did manifestly compress or pinch the fabric between the roll edges and the core precisely as in hand spinning; and this was evidenced when the spinning was completed by the pressure line left on the fabric which showed the path of travel of the spinning roll thereon and could not have been caused by the roll acting in a loop or bight as indicated in the patent. Such a line is left by the hand spinning roll as used in the hand spinning as I saw it in use many years ago.

Application of the Beads. The bead placing mechanism of the patent was entirely absent and the beads were applied by the aid of a bead placing ring, the method not in any way resembling the disclosure of the patent. No attempt was made to spin the fabric around the bead core with the spinning roll of the patent nor to trim the fabric while in the machine as there was no trimming mechanism provided. The core with the partially built carcass upon it, was removed from the tire building machine and these operations were performed by hand in the usual manner.

Quality of Work. The work which I saw was not as the patent says (page 7, line 49) "better than they can be made by hand", but was extremely poor, much worse than I remember having seen it done by hand and indeed the faults of the machine had to be remedied by hand both while the core was attached to the machine and after it had been removed therefrom.

In practically every layer of fabric applied very large and very bad wrinkles were formed and it was necessary to stop the machine and lift up the fabric and smooth it down by hand with a spade, after having applied cement underneath in some instances. In fact the word "wrinkles" appears too mild to apply to some of these as

they were not single wrinkles but groups covering considerable areas in which the fabric was mussed instead of smoothed there being colonies of wrinkles.

METHOD OF OPERATION. The method used by the operator when I saw him operating the machine, was the customary procedure of hand building of tires in which the fabric is stretched, to shape it to the core, and the rollers act toward the core to pinch the fabric against it and was not the method shown and described in the State patent in which the fabric is not stretched to shape it to the core and the spinning rolls act in a bight of the fabric and do not pinch the latter against the core. The fabric was very largely formed to the core by the act of stretching it and drawing it from the stock roll over the convex stretching roll. This stretching brought the fabric into contact with the core over fully a third of the surface of the latter. It was then only necessary for the tread roller to perfect the adhesion and the latter had no smoothing or shaping effect whatever to do so far as I could observe.

The fabric was so far shaped as to require less conforming or shaping to the core than would be the case in the mode of operation of the patent and the centrifugal force was of a much lower order. The spinning roll therefore was caused by the workman to act exactly as in hand spinning. The spinning around the bead was done by another workman who spun the core by hand and spun the fabric around the bead with an ordinary hand spinning tool. The trimming was also done by this second workman with a hand tool, and not by the machine.

Q. 17. Have you read the disclaimer filed by the plaintiff in connection with the State patent in suit, and do you understand same?

A. I have read the disclaimer several times with great care. In so far as it canceled certain claims, as too broad and including what State did not invent, and in so far as

it canceled certain portions of the specification I understand it; but as to those portions which disclaim claims 4, 5, 6, 7, 12, 13, 22, 23, 24, 25 and 26, except when the recited elements are in some vaguely suggested relation I have been unable to form any definite idea of the meaning.

Mr. Seward: I offer in evidence a printed copy of British Patent to Will Charles State No. 25588 of 1909 accepted April 28, 1910 and ask that the same be marked "Defendant's Exhibit G, British Patent to State."

Q. 18. Have you examined this British Patent to State, Defendant's Exhibit G?

A. Yes.

Q. 19. Will you state whether or not this patent shows and describes substantially the same machine as is shown and described in the patent in suit?

A. It does.

Q. 20. Do you find in this British patent any figures of the drawing which corresponds with Figs. 3, 4 and 5 of the State patent in suit?

A. Yes, all of the drawings appear to correspond figure for figure, and reference letter for reference letter.

Q. 21. Will you refer to the description contained in this British patent with particular reference to the gears 75 and 83, and their connected parts, and explain what the patent sets forth as to the relative speed of the said gears in operation?

A. In general the language of the specification of the British patent corresponds to the language of the United States patent. In the description of the gears referred to, however, there is a noteworthy difference in that the words "much more rapidly" found at page 4, line 3, as contrasting the speed of the gear 83 with that of the gear 75, are replaced in the British specification at page 4, line 49, by the words "more slowly".

I have pointed out that the United States patent specification is inconsistent with itself in its designation as to which of the two worm gears is the slow speed and which the high speed. Thus at page 4, line 3 it is said that the gear 83 "rotates much more rapidly than the gear 75", but in lines 11 and 12 of the same page, the sequence makes it clear that the reverse is intended and that the gear 83 rotates more slowly than the gear 75. On page 4, lines 77 to 79, the patentee states that the clutch 73 attached to the gear 83 is the slow speed mechanism and that the clutch 72 attached to the gear 75 is the high speed mechanism. Thus in two out of three places in the specification it is stated that the construction is not as assumed by Mr. Browne, namely, with some unknown and unshown high speed gear mechanism, but that the high speed gear mechanism is that shown in Fig. 4, indicated by the reference numerals 75 and 76 therein. The British patent statement is consistent in this regard since it expressly states in the passage corresponding to the one selected by Mr. Browne in the United States patent, that "the arrangement is such that the spiral gear 83 rotates more slowly than the spiral gear 75".

If the gear 75 is a high speed gear then the sprocket and chain arrangement will cause the shaft 78 to rotate slower than the shaft 58 and this of course is a rational arrangement. And if the worm and worm wheels are alike and the high speed is 207, then the low speed would be 138 R.P.M. which of course is entirely impracticable being 23 times as fast as the slow speed suggested by the patentee. The ratio of the worm and worm wheel is already 45 to 1. To get a speed of 6 revolutions per minute the gear ratio would have to be 1035 to 1 which of course is utterly impossible within any rational or permissible dimensions.

If the gear 75 is the high speed gear and the high speed is 207 revolutions as the patent states, then the

shaft 58 bearing the worm 76 would make 4057 revolutions a minute which is also impracticable. In the first place in machines of this character such speeds are intolerable on account of bearing and lubrication difficulties, but the absolute bar is the fact that worms cannot be run at any such surface speed. They immediately cut themselves to pieces.

Thus even with a consistent specification such as the British patent furnishes, we arrive at an impossible machine, and whether, therefore, Mr. Browne's view of the United States patent specification is taken or the description of the British specification be accepted, no disclosure of an operative machine capable of realizing the speeds set forth in each of the patents is found. Also if, in either case, we attempt to secure the result by changing the gear ratio of the worm and worm wheel we find that impractical constructive conditions are imposed which prevent such a solution of the difficulty.

Q. 22. Have you examined the drawing produced by Mr. Browne, after consultation with Mr. Ray, and offered in evidence as "Defendant's Exhibit A, Browne's Sketch of Gearing"; which drawing was suggested by Mr. Browne as a substitute for the worm and wheel 82, 83 of the patent in suit in order to obtain the high speed of 207 R.P.M. for the core? If you have examined this drawing, will you kindly state what you have to say with regard thereto as a proper interpretation of that part of the patent in suit?

A. I have examined the drawing. Such a drawing does not answer the question whether or not the gear can be made and transmit the necessary power. It is based merely upon working backwards and assuming that approximately the correct speed ratio can be obtained but does not show how it can be obtained.

The drawing of the patent shows in Fig. 4 an ordinary worm and worm wheel mechanism of recognized pro-

portions and presents no problem to any mechanic. The patent further says that the other one of the two worm and gear combinations is "just as" the first. Mr. Browne's sketch, Defendant's Exhibit A, does not show such an arrangement but on the contrary presents a problem (not a solution) in spiral gearing. This problem would have to be solved either by calculation or experiment, probably the latter, before anyone could tell whether teeth of proper proportion to stand the strains and transmit the necessary power could be cut of the required number and at the required angle on blanks of the relative diameters given and have the necessary strength.

If the description and drawing of the patent is to be disregarded in the effort to obtain the speed called for, namely 207 R.P.M., my judgment as an engineer would be that it would be better to re-design the mechanism and adopt some more normal arrangement than that indicated in Mr. Browne's sketch, Exhibit A, I may note that in the Goodyear machines which I saw, even though the speed requirement was much less exacting, namely only about 120 R.P.M., the high speed gear mechanism had been re-designed, the worm wheel being abandoned and a pair of spiral gears of approximately equal diameter substituted therefor. Mr. Browne's sketch of gearing is not a drawing showing gears but merely a diagram indicating only what he assumes, namely, that if you have 22 teeth on each of two gears they will run at 1 to 1 ratio if they run at all. But of course anyone knew that without a diagram, also any engineer knew that the sum of the angles of the teeth of the two members had to be 90 degrees, but this is all that the sketch shows. Of course the diagram does not show and I understand does not purport to show an arrangement which would operate.

Q. 23. Am I correct in understanding from your testimony that, as you read the drawings of the State patent in suit and the parts of the specification descriptive

thereof, the worm and wheel 76, 75 are the same as the worm and wheel 82, 83, and that the difference in speed of the wheels 83 and 75 is due to the difference in size of the sprockets around which the chain 80 passes, the arangement being such that the wheel 83 rotates more slowly than the wheel 75?

A. Yes, I will refer to the specification beginning at page 3, line 123 and extending to page 4, line 4: Since the sprocket chain obviously rotates the shaft 78 and hence the gear 83 more slowly instead of more rapidly, it appears likely that the draftsman of the specification reversed the reference numbers in lines 2 to 4 of p. 4, and that he intended to say that the spiral gear 75 rotates much more rapidly than the spiral gear 83. This would make the passage consistent with the sentence beginning line 8 of the same page and also the passage beginning at line 73. It would also then bring the specification into agreement with the British Patent of State.

The criticisms which I have made of the machine on this interpretation would still apply, but the specification would not be inconsistent with itself as it now is.

Q. 24. If the patentee had intended that the gear wheel 83 should be part of the high speed drive, can you conceive of any reason why he should have arranged the sprockets and chain 80 so as to cause the shaft 78 to rotate more slowly than the shaft 58?

A. No, from a mechanical point of view such an arrangement is quite irrational.

Q. 25. If the patentee had intended to use a pair of spiral gears for obtaining his high speed, as is suggested by Mr. Browne, can you conceive of any reason why he should place them in the position of the worm and wheel 82, 83 instead of in the place of the worm and wheel 76, 75, considering, as you have already described, that the shaft 58 is more directly driven from the source of power than is the shaft 78?

A. No. The shaft 58 is the natural one from which to take the high speed drive since the driving motor is naturally the high speed device and the high speed drive of the machine should therefore be naturally taken from the shaft driven by the motor with the least reduction. In other words, there is no good reason in the mechanics of the structure why the designer should deliberately elect to take the loss of power necessarily involved in first gearing down and then gearing up again.

Q. 26. If the arrangement shown on the sketch of Mr. Browne's, Defendant's Exhibit A, were intended to be represented by the patentee, by the parts 82 and 83, how would the cross section of the gear wheel 83 differ from that shown in Fig. 3 of the drawings of the patent in suit?

A. The drawing of the patent in suit would then show the gear 83 as having sections of 3 teeth indicated instead of a side view of one complete tooth as it now is. I note that Mr. Browne's sketch of gearing, Defendant's Exhibit A, is incorrect in its upper left hand figure if that figure is intended to represent the vertical cross section of the lower right hand figure, just as Fig. 3 of the patent would have to be regarded as incorrect if there was any evidence to indicate that it was intended to show such a gear arrangement as that of the lower right hand figure of Mr. Browne's sketch. Mr. Browne's upper left hand figure, however, is not only incorrect in improperly showing the teeth of the wheel 83, but it is also incorrect in failing to show the teeth of the wheel 82. In other words, Mr. Browne's upper left hand figure would correctly illustrate the cross section of what the patent actually discloses, but incorrectly illustrates the structure of his lower right hand figure which he proposes to substitute. The gear 82 in the upper left hand figure should show in cross section 22 teeth instead of indicating as it does, the single thread worm.

Q. 27. If the patentee had wished, would there have

been any difficulty in showing several teeth in section on the gear wheel 83 in Fig. 3 of the drawing of the patent, instead of 1 tooth in side view?

A. Not the slightest, just as there is no difficulty in showing 45 teeth in the gear 75 in Fig. 4.

Adjourned to Saturday, June 14, 1919, at 10.30 A. M.

NEW YORK, June 14, 1919, 10.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

EXAMINATION OF MR. WATERMAN CONTINUED:

Q. 28. Have you read Defendant's Exhibit F, Mathern Belgian Patent, and the translation thereof included in said Exhibit, and do you understand the same?

A. Yes.

Q. 29. Have you had set up and seen in operation a tire making machine made substantially in accordance with the disclosure of the said Belgian patent?

A. Yes.

Q. 30. Is that machine represented in the set of 18 photographs Defendant's Exhibit D?

A. Yes, except that both rolls over which the fabric passed on its way from the stock roll to the core were oval shaped instead of one oval and one spherical, and that there is only one bevel gear arranged with its axis in line with those of the oval rollers exactly as shown in Fig. 1 of the Belgian patent, instead of two on each side as shown in photographs. Also the spinning rolls were made to avoid a criticism made in the other case in that the support on the inside, that is the side towards

the tire, is of the same thickness as the supporting hook instead of thinner than the supporting hook as is shown in the photographs. This thickness bears the same relation to the dimensions of the roller as is indicated in the drawing of the Belgian patent, Fig. 6. All of these changes were made under my direction upon my attention being called to the fact, by counsel for defendant, that the machine shown in the photographs had been criticised in these respects by counsel for plaintiff in the former suit of Seiberling against Firestone. I do not regard any of these changes as material. The replaced parts shown in the photographs have been retained without alteration of any kind.

Mr. Seward: The machine referred to by the witness is offered in evidence as "Defendant's Exhibit H, Machine of Mathern Belgian Patent."

(Witness continues his answer.) I may say that we also used a round sided core instead of one having flat sides to meet another objection raised in the former case. I will also state that I did not change the separation of the pins 35, notwithstanding objection made on this ground in the former case, because on comparing the separation with the distance from the central plane of the core to the central plane of the feed screw as shown in Fig. 3, I found their present separation to be substantially correct, that is, as close as may be reasonably scaled from so small a drawing. This criticism therefore appeared to be without foundation.

Q. 31. Will you please describe the construction and operation of the machine shown and described in the said Mathern Belgian patent, and compare the same with the construction and operation of the machine set forth in the State patent in suit?

A. Like the machine of the State patent the Mathern Belgian patent shows a machine provided with means

for supporting the supply of fabric, conveniently supported tools for hand guidance and control, and means for rotating the tire core at low speed for drawing the fabric onto the core and a high speed for laying it smoothly in adhesive contact with the whole surface of the core. Like the State machine, the Mathern machine of the Belgian patent includes spinning or stitching rolls, a bead placing device and a trimming tool. Unlike the State machine, however, the Belgian patent machine discloses automatic means for feeding the spinning rolls inward radially as the fabric is being spun upon the core, whereas the only means which the State patent shows is a hand wheel 124 which the operator must manipulate in order to cause the spinning rolls to progress radially inward. Also unlike the State machine, the gearing arrangements for obtaining the two different speeds are fully and clearly disclosed and of a type universally used for the speed changes in lathes.

The machine comprises a bed plate 1 upon which a bearing supporting frame 2 is mounted. This also carries the column supporting the automatic feed mechanism and guideway for the several tools.

The tire core 10 is mounted upon a shaft 12 which in turn is mounted in bearings on the frame 2. Parallel to the shaft 12 and to the left thereof as seen in Fig. 2 are two shafts 11 and 13 and these are arranged to be connected in either of two manners by gears 4 to 9. The gear 9 is mounted upon the core shaft 12 but is free thereon except when engaged by the clutch member 15 which is keyed to the shaft 12. A pinion 8 on the shaft 11 is permanently in mesh with the gear 9 and permanently connected to the gear 7 also on the shaft 11 and keyed thereto. Also on the shaft 11 is a step pulley 3 on which a driving belt for supplying the motive power is to be placed. Attached to this step pulley is a pinion 4 but this pulley and pinion are free from the shaft

except when clutched thereto by a clutch not lettered but clearly shown in Fig. 2. The shaft 13 carries a gear 6 meshing with the pinion 4 when desired. This gear 6 has attached thereto a pinion (designated 5 in the specification) which meshes with the gear 7. The shaft 13 is mounted in eccentric bearings rotatable by the handle 14 so that the gear 6 and pinion 5 may be thrown into and out of mesh with the pinion 4 and gear 7 respectively according as low or high speed is required. When all the gears are in mesh as indicated in the drawing, and power is applied to the pulley 3, this pulley rotating freely upon the shaft 11 will drive the gear 6 and the pinion 5 associated therewith at a slower speed. The pinion 5, being meshed with gear 7, will drive the latter at a still slower speed and the pinion 8 meshed with the gear 9 will in turn drive the latter and the core at a still further speed reduction.

The Belgian patent describes this low speed as that "sufficient" for all of the low speed operations and it will be observed that the means of getting this low speed is the ordinary "back-gear", shiftable by lever 14, this being the universal method of doing exactly the same thing in lathes and in other machines where a work shaft is to be turned at two different speeds. In addition a step pulley 3 is provided, so that altogether such a machine may operate at 6 different speeds or at 2 different speeds for every position of the driving belt.

The gear ratio as approximately indicated by measurement on the drawing is 4½ to 1 for each step in the gear train, which makes a ratio of 91 to 1 from the driving pulley 3 to the core 10. Thus if the core has a slow speed of 4 revolutions per minute, which would be as slow presumably as it would ever want to be run, the driving pulley would have a speed of 364 revolutions which is a practical and usual speed for such a driving pulley. The steps of the pulley would then provide for low speed

drives of 4, 6 and 8 revolutions per minute according to which step of the pulley the belt was applied to, and the driving pulley speed, from a constant speed original source of power, would vary from 364 to 728, an entirely common and usual range. The speed drive is thus a practical one.

The purposes for which the low speed drive is intended are stated on page 2 of the translation as follows:

> "The core 10 under this condition rotates at a speed sufficient for winding on the strips of fabric, placing the beads, placing the rubber strips, etc."

These several operations then the patentee contemplated would be performed with the back gear lever 14 moved to mesh the gear 6 and pinion 5 with pinion 4 and gear 7 respectively.

To obtain a high speed the lever 14 is moved to throw the back gear out of mesh and the pulley 3 is clutched to the shaft 11 precisely as the similar operation is performed in a lathe. This alters the speed ratio by 4½ to 1 so that the ratio of the low speed to the high speed for the same position of the driving belt is 1 to 20¼. This means that if the low speed is 4 revolutions per minute the high speed would be 81 revolutions per minute. If the low speed were 6 revolutions per minute the high speed would be 121½. If the low speed were 8 the high speed would be 162 R.P.M.

Mathern states in the last paragraph of page 2 of the translation, that the high speed so obtained is the speed which is "necessary" for spinning the fabric into close contact with the core. His statement reads as follows:

> "When this is done, (back gear thrown out) and core is clutched to its shaft, the pinion 8 keyed on the latter directly drives the shaft 12 through the wheel

9 and under this condition the core 10 has the speed which is necessary for removing the puckers from the fabric strips on the core, for trimming off the fabric strips, for rolling the finished carcass, etc."

It will be noted that the patentee appears to distinguish between the speed which is "sufficient" for winding on the fabric and the high speed which is "necessary" for the spinning operation. I understand that Mr. Browne, plaintiff's expert, says that the necessary effect of speed only begins at 50 revolutions per minute and is practically realized at from 80 to 120 revolutions. I assume (adopting the results of Mr. Browne's experiments) that this necessary speed referred to by Mathern, is 80 to 120 revolutions which gives a low speed of 4 to 6 R.P.M. which is known to be "sufficient" although not the upper permissible limit. Thus the speeds in all parts of this driving mechanism are in every way practical and expected, and if the machine were simply set up and driven at what an ordinary machinist would recognize as a suitable or ordinary speed for a machine of this general type, the resulting high speed would be substantially that which Mr. Browne finds desirable.

The stock roll containing the prepared fabric is indicated at 18 mounted upon the squared end of a shaft 20 mounted in slidable bearings 25 so that its distance from the core may be regulated to adapt the machine for different sizes of cores. The flanges 19 of the stock roll are also adjustable so as to provide for different widths of fabric. To provide the tension the shaft 20 also has mounted upon it a drum 21 about which brake bands 27 are wound and arranged to be tightened by a screw and wheel 22, 23 against the tension of a spring 24, thus providing a uniform elastic tension adjustable at will.

Adjourned to Monday, June 16, 1919, at 10.30 A. M.

NEW YORK, June 16, 1919, 10.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

DIRECT-EXAMINATION OF MR. WATERMAN continued:

From the stock roll 18 the fabric passes to the pair of spherical or oval rolls 26 and thence to the core. These rolls thus constitute a means, as the patentee points out, of stretching the fabric in the middle to shape it to the core when the brake-wheel 23 has been adjusted to produce the required tension. This is described beginning at the last paragraph of page 3 and including the first two paragraphs of page 4 of the translation. According to the specification there is mounted at each side between the rolls 26 a pair of conical gears 36 between which the fabric passes, the purpose being to produce a uniform puckering of the edges of the fabric to facilitate the contraction thereof when the fabric is spun down against the core.

Thus in the act of stretching the fabric on to the previously cemented and therefore sticky core, the patentee shapes it by stretching the middle. It will be recognized that, if a fabric be stretched along its centre, it will at once take a curved form, and according to the amount of stretch given the fabric, can be more or less completely pre-shaped.

The pre-shaped portion then has to be stuck down against the core with the air bubbles completely eliminated. This is effected in the Mathern machine by a pair of rolls 30 mounted symmetrically to the plane of the core upon a pair of pivoted levers which in turn are mounted upon a slide in a casing 28. This slide is reciprocated a short distance back and forth by a crank shaft 33. The casing 28 is mounted on a slide 34 adjustable by a hand wheel to accommodate the different sizes of

tire. As the material is being stretched upon the core the rolls 30 are reciprocated by shaft 33 and the shaped portion is closely pressed on to the cemented core.

It remains to shape and apply the previously unshaped fabric portions and this is done by the tool shown in Fig. 6 which comprises a spinning wheel mounted at a receding angle upon a bar bent to embrace the rod 35 attached to a vertically-sliding tool supporting member 17 seen in Figs. 1, 2 and 3. This tool supporting member is in effect a heavy plate mounted in guideways on the column 16. A feed screw determines the position of this slide 17 and is adjusted by a hand wheel at the top and may be automatically fed downward by a pawl mechanism 34. Thus the spinning rolls progress radially inward along the tire surface but in a vertical direction instead of in a horizontal direction as in the State machine.

The spinning rollers arranged as shown in Fig. 6 are very cleverly devised so that they merely hook over journal pins 35. They are guided and pressed to the work by the hand of the workman applied to handles thereon as clearly appears in Fig. 6. It results from this mode of mounting not only that they are readily applied and removed, but that if they encounter an obstacle while being positively fed downward, they simply lift from their pivots. Thus if they should happen to come down on top of the core, they would lift instead of jamming and breaking something. Similarly if they should run against the bead after it had been applied, they would lift instead of forcing the bead out of place. At the same time they are completely under the control of the workman.

It results from this arrangement that it is impossible for these rollers to act on the tread portion as they would simply be lifted off from their supports, but this portion has already been applied by the rollers 30 and the action of the spinning roll is not needed. They therefore act

on the sides of the core where the fabric has not been previously formed by stretching.

After the layer of fabric has been stretched on the core and applied thereto by the rollers 30 so far as prepared for that purpose by stretching, the workman stops the machine, cuts off the fabric and properly overlaps and presses together the slightly overlapped ends. He then by means of the hand wheel adjusts the position of the slide 17 so as to bring the spinning roll of Fig. 6 about to the level of the top of the core. He then starts the machine and assumes the position for holding the handles of the spinning tools, there being two of these, one for each side of the core. By the time he has assumed this working position and is ready to apply pressure, after having started the machine, the spinning rolls will have reached the proper level to begin action and the operator presses them heavily against the core thereby pinching the fabric between the spinning rolls and the core and spinning it smoothly into shape simultaneously applying it to the cemented surface of the core.

Other layers are put on in similar manner and, at the proper time, the beads are put in place by the tool hook shown in Figs. 7, 8 and 9. I do not understand, however, that these further steps are of interest herein and I therefore omit a description of them. I note however that the Mathern machine is provided with all the tools which the State machine has and in addition is provided with means for applying the tread rubber after the canvas carcass has been completed. This is shown in Figs. 10 and 11.

Thus I find from this comparison that the Mathern machine supplies all of the tire making instrumentalities furnished by the State machine, but, whereas the State machine is a mere aggregation of the tools, the Mathern machine has automatic feeding means making it in a real sense an automatic machine, as distinguished from an assemblage of tools.

Like the State machine, as described in the specification of the State patent, the Mathern machine provides a sheet fabric supply roll together with suitable tension means and guide rolls, but these are clearly described as arranged to pre-shape the fabric by stretching, which is not provided for in the State patent. Also the Mathern machine has a power driven ring core having a slow speed mechanism to actuate the core when it is receiving fabric from the supply roll and a high speed mechanism for actuating the core while spinning the fabric against the core, and associated therewith change speed mechanism (lever 14 and eccentric bearings) for permitting the operator to select the desired speed. Unlike the State patent, this Mathern patent shows and describes a practical form of change speed mechanism whose constructional and operating characteristics are well known, while the State patent does not appear to disclose any practicable mechanism. The Mathern machine also has a radially moving support 17 and a pivotally mounted supporting arm (Fig. 6) on which is mounted a spinning roll as in the State machine. Mathern's spinning roll is not spring pressed toward the core, but the pressure is applied by the hand of the operator. The State patent describes a spring but when the machine was operated for me at the Goodyear plant the spinning wheel either was not spring pressed at all, or if at all, only to the extent of positioning the rolls, and the working pressure was applied as in the Mathern machine by the hand of the operator. I have pointed out that this difference between the machine and its operation as set forth in the State patent and the Goodyear machine and its operation was probably due to the fact that the State patent discloses a peculiar mode of operation by which the rolls operate in the bight of the fabric in view of a very high rotative speed whereas the Goodyear machines do not make use of any such mode of operation but operate at a much

lower speed after the ordinary method of hand spinning. The latter also is the mode of operation of the Belgian Mathern machine under consideration.

The spinning rolls of the Mathern patent shape the fabric to the core and stick it thereto in so far as it was not shaped by the preliminary stretching.

I call attention to the fact that the State machine is not safeguarded in any way to permit of automatic operation. Thus if the State machine were in the position shown in Fig. 2, and the feed wheel 124 were actuated automatically instead of by the hand of the workman, something would be smashed unless the operator remembered to grasp the handle 142 and so spread the wheels apart to permit the tire to enter between them. The Belgian patent provides for this contingency as I have pointed out by hooking the spinning tool over the journal pins 35 so that in case of the accident just mentioned, these tools would simply be lifted from their support and no harm could be done.

In my opinion this machine as fully disclosed in the Mathern Belgian patent comprises all of the elements and features necessary to a practical tire building machine in accordance with the previously well known hand method of building tires, where the State patent is not a clear disclosure of any machine suitable for carrying out either the old method of building a tire or realizing the peculiar mode of operation which the State patent seems to intend. The Mathern patent shows all of the features of the State machine except the spring pressure of the spinning rolls against the tire. Whatever may be said as to the special method of operation illustrated by Figs. 12 to 12c of the State patent, it would not seem that the spring pressure arrangement shown by State would be suitable for the ordinary method of building tires as practised by hand or with the Mathern machine or Goodyear machine.

I observe that in describing the rolls 36 above, I pointed out the fact that the specification describes a pair of such conical gears on each side but I omitted to note the fact that the drawing shows only one on each side. These gears are not described as having any important or essential function but are merely auxiliary refinements. The unformed portion of the fabric will of course pucker since it is too long for the circumference to which it is to be applied. By putting in regular creases the patentee Mathern gave to the fabric a tendency to pucker uniformly. Whether, therefore, there be one of these rollers or two is merely an unessential incident without any important effect upon the results.

I have noticed that the Mathern patent does not show springs for pressing the spinning roller toward the core. In this respect it differs from the showing of the drawings of the State patent. State however states that he includes, broadly, pressure exerted by the hand of the operator as a laterally yielding force for actuating the spinning roll. I therefore understand that absence of the spring for pressing the spinning roll toward the core does not exclude the Belgian machine from the description of the State machine. It would only be the work of a mechanic to add a spring.

It would appear therefore that unless the State patent is to be limited to the peculiar mode of operation disclosed by reference to Figs. 12 to 12c it is merely such a machine as is clearly disclosed in Belgian patent 194,731 to Mathern.

Q. 32. Will you state whether or not this Belgian patent discloses substantially the method of operation which you saw followed by the machines at the Goodyear plant, already mentioned by you?

A. In my opinion it discloses exactly the mode of operation practised with the Goodyear machines. Thus in both the fabric is stretched into partial conformation

with the core and the tread portion rolled into intimate contact therewith. In each the fabric is pressed against the core by heavy pressure applied to the spinning roll and is thereby conformed and stuck to the core. The only difference is that the Belgian patent automatically feeds the spinning roll radially inward while the Goodyear machines were hand fed.

Q. 33. Does this Belgian patent disclose an open tire shoe making machine which has a power driven ring core, a radially moving support, and a spinning roll mounted on the support for passing radially along the sides of the tire shoe to shape the sheeted fabric on the core?

A. Yes.

Q. 34. Does it show the spinning roll as mounted at a receding angle to the plane of the core?

A. It does.

Q. 35. Does it show the spinning roll as having a rounded disk shaped working edge?

A. It does.

Q. 36. Does it show a pair of such spinning rolls so mounted for simultaneous operation on both sides of the tire?

A. Yes.

Q. 37. Does it make provision for yieldingly forcing these spinning rolls laterally toward the core?

A. Yes, the spinning rolls are pivoted to swing to and from the core and provided with handles for yieldingly pressing the spinning rolls against the core. These handles are shown in Fig. 6 placed down close to the spinning wheel so as to give a large leverage and enable a heavy pressure to be exerted.

Q. 38. Does it show slow speed mechanism for actuating the core when receiving fabric from the stock roll?

A. It does and expressly describes it for this purpose.

Q. 39. Does it show fast speed mechanisms for

actuating the ring core during the operation of the spinning roll?

A. It does and describes it for this purpose.

Q. 40. Does it show speed changing mechanism for changing from the low speed to the high speed and the opposite?

A. It does.

Q. 41. Is the radially moving support which carries the spinning roll, in the Belgian patent, a radially sliding support?

A. Yes, it is carried on a slide moving in guideways and is fed by a screw, as in the State patent, but in the Belgian machine the screw is fed automatically.

Q. 42. Have you read and do you understand U. S. Patent to Vincent No. 794,473 dated July 11, 1905?

A. Yes.

Mr. Seward: I offer in evidence copy of the said Vincent Patent and ask that it be marked "Defendant's Exhibit J, Vincent Patent."

Q. 43. Will you please describe the machine disclosed in this patent and compare it with the machine of the State patent in suit?

A. The Vincent machine shown and described in the patent is intended for making the same sort of tire as is the State machine, and it comprises a stock roll and stretching mechanism for shaping the fabric as it is drawn from the stock roll onto the core. It also comprises mechanism for sticking the fabric to the core as well as mechanism for the subsequent operations. It also has a power driven ring core. It differs however from the Mathern machine or the State machine in that it has only one speed. This is because it stretches the fabric so nearly to the final shape that spinning rolls are not necessary. Looking at Fig. 4, the machine comprises a stock roll 13 from which the fabric passes over a guide roll 15, thence over a cylindrical tension roller 16 and thence

over an oval shaped roller 17. The two latter are geared together and of such relative diameter as to stretch the fabric, and the specification states that it is stretched until the centre has a length equal to the circumference of the outer surface of the tire core while the edges have the circumference of the inner edge of the tire core. From the roller 17 the fabric passes to the core. This is revolved by a worm 6 and worm wheel 7 from the shaft 5 as seen in Figs. 1 and 2. The canvass thus goes on the core already stretched substantially in shape. To apply it closely thereto a series of hammers is provided arranged to strike the fabric against the core, there being a succession of such hammers mounted progressively radially inward. These are power driven by shaft 22 as seen in Fig. 2 and operate to pat or hammer the fabric against the core. These hammers act progressively radially inward as the core with the fabric applied to it rotates, thus laying the fabric smoothly against the core with a progressive inward radial action. These hammers are spring pressed toward the core, the mechanism acting merely to move them away and at the proper time allow the springs to actuate them against the core pinching the fabric against it. Thus the fabric is smoothly applied to and stuck to the core with a progressive inward radial motion as the core rotates.

Thus this Vincent machine has in a machine for making open bellied tire casings, a stock roll or fabric supply, means for tensioning and stretching the fabric, a power driven ring core and radially acting means for applying the fabric smoothly to the core.

Q. 44. Have you read and do you understand U. S. Patent to Seiberling and Stevens No. 762,561, dated June 14, 1904?

A. Yes.

Mr. Seward: I offer a copy of the Seiberling and Stevens Patent in evidence and request that it be marked "Defendant's Exhibit K, Seiberling and Stevens Patent."

Q. 45. Will you kindly describe the machine disclosed in this patent and compare it with the machine of the State patent in suit?

A. The Seiberling and Stevens patent also shows a machine for the making of open bellied tire casings. It comprises fabric tensioning means for fabric drawn from a source which the patent does not show. This tensioning mechanism is the group of mechanism seen in Fig. 1 bearing the group of reference numbers 39-49. The fabric is adjustably pinched between rollers 43, 46. A rotating ring core 8 is provided adjacent to the tension mechanism and the rotation of the core draws the fabric through the tension rolls and stretches it on the core as indicated by dotted lines in Fig. 1. A tread roller 17 with side flanges 18 and power driven (as more fully shown in Fig 5) presses the stretched fabric over the tread portion and the flanges 18 are held against the fabric by rollers 52 laterally spring pressed toward the core by spring 54, which press the fabric down against the side of the core.

The rotation of the core next carries the fabric between a pair of shaping or smoothing fingers 85 which have a radial reciprocating motion best seen by reference to Figs. 1 and 6. These reciprocating fingers act radially to shape and smooth the fabric radially inward and imitate the action of the "spade" sometimes used in the hand building of tires for the same purpose. The fabric next passes between a pair of stitching rollers mounted at a receding angle as seen in Figs. 1 and 4, under control of the workman. These rollers 91 act to force the fabric into the crease at the extreme inner portion of the core as best seen in Fig. 4. The machine is also provided with bead placing means, very similar in general to that shown in the State patent in suit.

Like the State machine the Seiberling and Stevens machine has a power driven ring core, a tensioning means

for fabric drawn upon the core, a tread roller with spring pressed flanges for smoothing the fabric over the tread portion, also partly on the sides in the Seiberling and Stevens machine. This tread roller also constitutes, in the Seiberling and Stevens machine, the means of propelling the core and, as shown in Fig. 5, it may be driven at various speeds by sliding the gear 19 by means of the arm 21 provided for that purpose. Thus the machine may, like the State machine, have a high and low speed drive. Also like the State machine, there are radially acting means for smoothing the fabric and shaping it to the core, these means consisting of radially acting smoothing fingers and radially acting stitching rollers. I note that, as shown in Figs. 1 and 6, the radially acting smoothing fingers are power pressed toward the core to pinch the fabric against the core.

I note that the stitching rolls are disk shaped wheels, are arranged for simultaneous action on opposite sides of the tire, are radially movable with respect thereto, are arranged at a receding angle and are provided with means for pressing them laterally towards the core to act on the inner portions of the fabric after the tread roll has acted thereon.

Q. 46. Have you read and do you understand the U. S. Patent to Moore, No. 518,112, dated April 10, 1894?

A. Yes.

Mr. Seward: I offer in evidence printed copy of the Moore patent and request that it be marked "Defendant's Exhibit L, Moore Patent."

Q. 47. Will you please describe the machine disclosed in the Moore patent and compare the same with the State patent in suit?

A. The Moore patent shows a machine for making open bellied tire casings which consists generally of a power driven ring core and a group of tools for acting

upon the fabric conveniently arranged above the core to be selectively employed by the workman in forming the tire. These tools are mounted each upon a lever pivoted above the machine as seen in Figs. 1 and 2 and normally elevated by counterweights passing over a pulley.

Adjourned to Tuesday, June 17, 1919, 10.30 A. M.

NEW YORK, June 17, 1919, 10.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

EXAMINATION OF MR. WATERMAN CONTINUED:

The ring core is of peculiar construction having an expansible inner portion and a removable outer split rim 49 best seen in Fig. 3. This rim when removed from the expansible central part or spider may have its ends overlap so as to materially reduce its diameter. To form a tire the specification says "a piece of lining fabric or material having been made into the form of an endless ring by means of cement or sewing is then put on the shell." The central spider seen in Fig. 2 being suitably contracted, the shell or tread portion is placed upon it and the spider expanded by means shown in Fig. 1 so as to stretch tightly the endless ring of lining material which has been applied to it. In this manner the stretching operation is carried out.

Endless wires or threads are then formed in the depression on the rim, the fabric turned back and the laying down accomplished with the spinning rolls 47 and 48, the latter being sharper edged than the former so as to get down into the bottom of the hollow.

The specification does not limit the use of the machine to any one particular form of core, and it is obvious that any of the forms now in use might be employed. The

specification expressly states, page 2, line 107, that it may be "of any other desired and approved shape".

It is evident that this machine provides, in connection with a power driven core, an assemblage of tire makers tools above the core. Thus the rolls 701, 702 are for spreading and working the cement on the fabric. The roll 44 is a hollow pneumatic tread roller which conforms itself automatically and perfectly to the shape of the tire and removes the air bubbles while rolling the fabric into close contact with the core. The rolls 47 and 48 are spinning rolls, roll 47 having a thicker edge, that is, rounded on a larger radius, while the roller 48 is for working down at the extreme edges. These rollers are mounted so as to permit both radial and lateral movement with respect to the core.

In other words, this patent clearly discloses the idea of a power driven core and a mode of conveniently assembling any tire tools that the workman may happen to need for the particular shape of core and condition of fabric or cement. These tools are conveniently mounted so that all the workman has to do is to let go of them and they will automatically be raised out of his way while he grasps another tool.

As compared to the State machine, it is evident that the Moore machine has the means for mounting and dismounting the core, consisting of an expansible spider or chuck, and a demountable core, the whole constituting a rotatable ring core. Means is provided for driving it by power at what the patentee calls a high speed. Thus he says, page 3, line 73,

> "The rotation is kept up at a high rate of speed during the performance of the operations which now are proceeded with."

There is also a tread roller for conforming the fabric to the tread portion of the core and spinning rollers for conforming it to the other portions, the fabric having been

previously stretched to shape as just above stated. It is evident that this is a practical tire building arrangement which could be used for any shape of tire of the type here under consideration, so far as concerns the spinning of the fabric against the core to shape it and bring it into closer adhesion. It of course does not show the bead placing and trimming arrangements found in the Seiberling and Stevens, Vincent, Mathern and State patents. It can hardly be said that the State patent is in any sense more automatic than is the Moore patent since in each case the stretching of the fabric on the core and its rotation is all that is done by the driving power, many elements of the machine being merely conveniently located tools appropriately grouped with reference to the rotating core and which the workman may use according to his discretion.

Q. 48. Have you read and do you understand U. S. Patent to Jeffery No. 607,245 dated July 12, 1898?

A. Yes.

Mr. Seward: I offer in evidence copy of the Jeffery patent and request that it be marked "Defendant's Exhibit M, Jeffery patent."

Q. 49. Will you please describe the construction shown in the Jeffery patent and compare it with the machine of the State patent in suit?

A. The Jeffery patent relates primarily to a tire and only incidentally describes the machine. The peculiarity of the tire is that instead of being built substantially in the form it is desired to have when it is on the rim, Jeffery proposes to build it as a nearly flat band with suitable beaded edges to properly engage the rim on which it is to be used, as shown in Fig. 4. The tire is built by stretching bias cut fabric, rubber impregnated, on a revolving core wheel appropriately shaped as shown in Fig. 2, the core being mounted in suitable bearings to be revolved. The core has formed in it depressions A′ and the fabric after having been stretched on to the core is stretched or

depressed into the grooves by the use of the wheels or rollers C which the specification says have a "dull knife-edge periphery". These rolls are mounted as seen in Figs. 1 and 2 so as to be movable radially toward the core and into the groove. By their action, the fabric is tucked into the groove and laterally stretched as described at page 1, line 67 and at page 2, line 70, also line 12. The specification says that a single wheel C as shown in Fig. 3, may be employed, but that he prefers the double wheel arrangement "so that both wheels may be simultaneously pressed up against the wheel A as the latter revolves and the fabric stretched into both grooves at once" (p. 2, line 47). The patentee says that the advantage of this is that "the fabric is drawn both ways from the middle at once and is not stretched out of position as it might be if one line only were operated at a time" (p. 2, line 53).

As compared with the State patent the Jeffery patent shows the idea of a revolving core on which the fabric is to be stretched and a conveniently mounted wheel for performing the necessary operation of working the fabric into place and into proper shape. In neither case is the operation automatic, the machines both being merely assemblages of tools rather than automatic machines in the ordinary sense.

Q. 50. Have you read and do you understand U. S. patent to Bayne and Subers No. 847,041, dated March 12, 1907?

A. Yes.

Mr. Seward: I offer in evidence copy of the Bayne and Subers patent and request that it be marked "Defendant's Exhibit N, Bayne and Subers Patent."

Q. 51. Will you please describe the machine shown in this Bayne and Subers patent and compare it with the machine of the State patent in suit?

A. The Bayne and Subers patent shows an automatic

machine for making cord tires as distinguished from fabric tires. It shows a rotatable ring core of substantially the shape used at the present time and rollers such as 19 arranged at a receding angle and automatically fed to lay the cords, previously saturated with rubber, firmly against the revolving core. There are three groups of these rollers for different portions of the tire surface namely, the rollers 19 and 36 as best seen in Fig. 4 and the rollers 50 as best seen in Fig. 5. These rollers are spring pressed against the core and are automatically fed as are, for example, the rollers of the Mathern machine which I have already described. The machine is shown provided with cranks 17 as a means of revolving the core, but the patentees state, page 2, line 15, that they do not intend to limit themselves to such a means.

It is clear that as regards the elements of a demountable rotatable ring core, power driven and radially fed rollers aranged at a receding angle and spring pressed against the core, to squeeze the threads between the rollers and the core, and to progress in regular fashion over its surface, the Bayne and Subers patent is such a machine as is shown in the State patent. Indeed, there is no apparent reason why by simply rotating the machine in the opposite direction so that the wheels 19 would progress radially from without inwards (instead of in the reverse direction as when laying on the cords) this machine would not readily spin the fabric of a fabric tire smoothly down against the core. In any event it clearly shows the idea of a revolving core and suitable tools in the form of spring pressed rolls arranged for operating upon the core as in the State patent. The machine appears to be a simple and practical structure for its intended purpose.

Mr. Seward: I offer in evidence copy of German patent to Mathern, No. 206,197, filed December 20, 1906, ausgegeben January 26, 1909; together with copy of certified translation of the same furnished by

the United States Patent Office, with request that the patent and translation be marked collectively "Defendant's Exhibit O, Mathern German Patent."

It is stipulated between counsel that this translation may be received in evidence, subject to correction if error be found therein.

Q. 52. Have you read and do you understand Defendant's Exhibit O, Mathern German patent?

A. Yes.

Q. 53. Will you please describe the machine shown in this German patent and compare it with the machine shown in the State patent in suit?

A. The Mathern German patent shows a machine which in all of its major features is substantially the same as that which I have already described in considering the Belgian patent. The chief features of difference are that the German patent shows two conical gears 36 on each side through which the edges of the fabric pass as the fabric is drawn from the stock roll and stretched before being applied to the core. The Belgian patent describes two such gears but shows only one. The German patent rolls 30 are shown as spring pressed toward the core, by springs arranged against the arm spring 1 just as the springs 145 are arranged in Fig. 9 of the State patent. In addition, the German patent shows in Figs. 1 and 3 thereof, an arrangement of stepped spinning rolls 38 carried on arc shaped bar 29 arranged to be reciprocated to progressively smooth down the fabric and shape it clear to the inner side of the core in a single rotation instead of a number of revolutions as is necessary when a single pair of spinning rolls is employed. This arrangement of stepped spinning rolls appears to be an equivalent mode of operation intended to save time.

Mr. Seward: I offer in evidence copy of French patent, to Hernandez, No. 395,812, filed January 7,

1908, granted January 8, 1909, published March 19, 1909, together with copy of translation of the same certified by U. S. Patent Office, and request that the patent and translation be collectively marked "Defendant's Exhibit P, Hernandez Patent."

It is stipulated between counsel that this translation may be received in evidence, subject to correction if error be found therein.

Q. 54. Have you read and do you understand Defendant's Exhibit P, Hernandez French patent?

A. Yes.

Q. 55. Will you please describe the machine shown in this French patent and compare it with the machine shown in the State patent in suit?

A. The Hernandez patent indicates by a series of detailed drawings a tire making machine arranged as diagrammatically indicated in Fig. 1. There is a power driven ring core *d* mounted for rotation as shown in Fig. 5. The arrangement of the supply roll and guide rollers *c1, c4, c5,* is shown at the right of Figs. 1 and 2. There is a tensioning means as indicated at *c3* as a brake band weighted to apply the tension.

The fabric is drawn off onto the core as indicated by the line *x* in Fig. 1 and as the core rotates, passes in front of a group of spinning rolls mounted upon a rotatable support i^1. This is driven by a separate belt as indicated at the left in Fig. 1. Each of these spinning rolls is a disk with round edge as seen in Fig. 6. There are a number of such spinning rolls spring pressed towards the core and although not actually shown in the drawing, the specification states that there is a similar arrangement to operate on the opposite side of the tire. As the core *d* rotates the support i^1 also rotates at a very much higher velocity, the rolls i^1 being carried successively inward across the entire side of the fabric upon the core,

thus shaping it and pressing it against the core. The arrangement is a very ingenious plan of making the shaping operation automatic.

There is also means for applying the bead and for shaping the fabric about it shown in detail in Fig. 7 and in operative relation at j^2 to j^6 in Figs. 1 and 2. The specification says that there is a duplicate set of these for the other side of the core.

It thus appears that this machine was to a very large extent an automatic machine for making tire casings of the sort referred to in the State patent and having a power driven ring core, a stock roll and tension devices co-operating therewith, and forming rolls laterally spring pressed toward the core, and arranged to move in a generally radial fashion inward over the fabric to press the latter against the core and to form and smooth it thereon.

Mr. Seward: I offer in evidence copy of U. S. Patent to Dewey, No. 438,407, dated October 14, 1890, with the request that it be marked "Defendant's Exhibit Q, Dewey Patent," also copy of U. S. Patent to Seymour No. 80836, dated August 11, 1868, with the request that it be marked "Defendant's Exhibit R, Early Seymour Patent"; also copy U. S. Patent to Seymour No. 376,167, dated January 10, 1888, with the request that it be marked "Defendant's Exhibit S, Later Seymour Patent."

Q. 56. Have you read and do you understand the Dewey patent and the two Seymour patents just offered in evidence?

A. Yes.

Q. 57. Will you please describe the structures shown in these three patents and compare them with the disclosure of the State patent in suit?

A. The operation which I have referred to as spinning

down the fabric to shape it and apply it to the side walls of the tire casing inside of the tread portion is merely an illustration or particular application of a well known mechanical process known as spinning. It is of course an entirely different use of the word "spinning" to that in which it is employed in textile work as referring to the forming of yarns.

The three patents just offered in evidence illustrate this mechanical operation of spinning as applied in machine shop practice. The Seymour patent 80836 and Dewey patent 438,407 illustrate the practice as applied to thin metals, while the Seymour patent 376,167 illustrates it as applied to heavy metals. The tool used in spinning metal in this manner is usually a wheel or roller and State was therefore merely using the terminology of the machine shop when he referred to his rollers 147 as "spinning rolls". As these patents clearly indicate, the metal was spun over a form or core and gradually assumed the shape of that core as is very clearly shown in Figs. 2 and 3 of the Dewey patent 438,407. In this instance, the patent illustrates the work as done by hand; the core being rotated by power and the tool being guided by hand. This is probably merely because the invention which the Dewey patent more particularly sets forth, is a process of progressively annealing the metal as the spinning wheel advances over it. Both hand and machine spinning were very old in the art long prior to the time of the State patent. The Seymour patent 80,836 which was entitled "Spinning Metals" shows an arrangement in which a tool consisting of a spinning wheel like the hand spinning wheel of the Dewey patent, is shown as mounted for actuation by mechanical means and spring pressed toward the work. This would be a more usual arrangement where much spinning was to be done. In this patent the spinning wheel *t* is mounted in a manner analogous to the mounting of a lathe tool

in a compound rest, there being guides *k* whose angle to the work can be changed by which the spinning tool may be moved in a direction in general parallel to the work. At the same time by means of the handle *w* the tool may be withdrawn from the work. The spring *d* may be adjusted by the screw and handle *r*. Thus, as the core revolves the workman turns the handle *p* and moves the spinning wheel over the work, the spring causing the tool to conform to the varying outline thereof. The core shown in Fig. 1 at *c* is evidently of a shape such as might be used to spin up the canopy of a gas or electric light fixture.

The spinning operation requires a high speed and it was therefore only the obvious and natural thing for State in the patent in suit to suggest rotating the tire core at a high speed as that was the usual practice in spinning metal.

Looking at the Dewey patent for example, it will be seen that a flat disk of metal *a* is inserted between the core or former *c* and the tailstock *a*. This is then revolved at high speed and the spinning wheel *d''* is pressed against the core pinching the metal to be spun between the two. As the spinning tool moves over the core the metal is shaped to the latter but the centrifugal force holds the unspun portion standing straight out. Perhaps Mr. Browne will refer to this holding out as the action of "invisible fingers".

The Seymour patent 376,167 shows a machine for automatically spinning heavy metal and shows in the machine shown in Fig. 1 the spinning of the air chamber of a pump. The operation being performed is the tapering and flagging of the cylindrical part D. This is rotated by power and as it rotates a pair of spinning rolls *h'* are automatically fed downward shaping the metal as indicated by dotted lines. The peculiarity of this instance of spinning is that it is not done over a

core, the metal itself being so heavy that the correct form may be given by merely correctly guiding the spinning roll, and this is done automatically by means of a guideway *f* on which the tool carrying slide *g* moves, the feeding being automatic by means of the feed screws E driven by gears E′.

These patents will suffice to illustrate the fact that the spinning down of the fabric onto a tire core, as I understand was common in hand practice, was merely a particular application of a well known mechanical process and that State in adopting this spinning tool, merely complied with the well known practice in the art when he provided means for rotating the core at high speed during the spinning operation, and a hand fed mounting for the tool as in the early Seymour patent just referred to, as well as a spring for pressing the tool toward the work.

Adjourned to Thursday, June 19, 1919, at 10.30 A. M.

NEW YORK, June 19, 1919, 10.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

EXAMINATION OF MR. WATERMAN (CONTINUED):

Q. 58. You have referred to the hand spinning method of laying down fabric as having been seen by you several years ago. Will you briefly describe this operation?

A. The core was mounted on a stand so as to permit it to rotate, and means was provided for supporting the core in either a vertical or horizontal position. There was also a device which could be used to hold the core against rotation in one direction. The workman put this

last named device into operative position. He then took a piece of bias fabric impregnated with rubber and stuck one end to the core, the core having been previously coated with cement. He then threw the other end of the fabric over his shoulder and stretched the fabric circumferentially on the core for a distance of about a foot or a foot and a half, by pulling on it with his hands. He then rotated the core a short distance away from him and again stretched on another part of the fabric. This operation was repeated until the fabric strip had been completely stretched once around the core. The workman then disengaged the device for holding the core against rotation in one direction so as to permit the core to freely rotate. He then rotated the core and applied to the tread portion and a little way down the side a cylindrical metal roller in order to smooth the fabric where it had been stretched on the core and remove any air pockets. He then caused the core to rotate rapidly and, taking a hand stitcher, applied it to the side of the core at about the edge of the part of the fabric which was adhering to the core, and then moved the hand stitcher radially inwardly while the core was in motion, pressing the stitcher laterally against the core all the time. This operation spun down the fabric on one side of the core, and it was then repeated on the other side of the core. The hand stitcher used was a disk-like metallic wheel or roller having a rounded edge and about two or three inches in diameter. It was mounted to revolve in a wooden handle. I saw this operation about seven or eight years ago and it appeared to be a regular factory operation. It was strikingly similar to the method of operation which I have described as being followed in the use of the machines exhibited to me at the Goodyear factory.

Q. 59. Do you find in the State patent in suit any recognition of the prior method of hand spinning.

A. Yes, I note that on page 5, beginning at line 108, the specification of the State patent says, "The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, strong spiral springs will be used. These springs exert the pressure against the fabric for forming it against the sides of the core which would be exerted by the arm of the workman in case of a hand-tool or a hand-pressed roll. In consequence, the work of these spring-pressed spinning-rolls is far more even and more rapid than in the case of a roll pressed against the core by hand". This seems to me to be a clear recognition of the hand-spinning of fabric on the core since it directly compares that method with the method followed by the State machine. I note further that the only difference which the patentee mentions as existing between the hand method and the machine method is that in the latter work of the spinning-rolls is more even and more rapid.

Q. 60. Have you examined and seen in operation the Defendant's tire making machine which was exhibited to Plaintiff's experts, and referred to in the *prima facie* case herein?

A. Yes.

Mr. Seward: I offer the said machine in evidence with the request that it be marked "Defendant's Exhibit T, Defendant's Machine".

Q. 61. Have you read and do you understand U. S. Patent to Thropp, Thropp & de Laski, No. 1,119,326, dated December 1, 1914, a copy of which is in evidence herein as Plaintiff's Exhibit No. 3, Patent on Defendant's Machine?

A. Yes.

Q. 62. Will you please describe the construction and operation of the machine "Defendant's Exhibit T", and

compare it with the construction and operation of the machine set forth in the State patent in suit; making reference if you wish to the said patent Plaintiff's Exhibit No. 3?

A. Patent 1,119,326 discloses a tire building machine for making the outer casing for pneumatic tires. It comprises a rotatable core, means above the same for adjustably mounting a stock roll of fabric to be stretched on the core. It has means for exerting a regulated tension on the fabric to stretch it to shape. It has spinning rolls mounted to move radially and to be fed automatically to spin the fabric against the core. It is also provided with means for trimming the fabric and there is a bead placing means for use in locating the beads upon the core while the tire is being built up in the machine but this means is not an attached part of the machine.

Defendant's Exhibit T, Defendant's Machine, is such a machine as is shown in the patent just referred to, and has the same elements as just described. I shall therefore in describing the machine make use of the drawings of the patent 1,119,326, Plaintiff's Exhibit No. 3, to indicate the several parts of the machine.

The machine comprises a casing 1 which serves to support the bearings and all of the several working parts. To this casing there is attached a stanchion 41 carrying the stock roll and tension mechanism and also brackets 85 and 143 carrying the spinning roll mechanism and trimming knife mechanism respectively. The rotatable core 104 is mounted upon a shaft journaled in the casing 1 and is arranged by means of gears 10, 11, 13, 14, 12^x and 16 and clutches 19 and 20, all as best seen in Fig. 2, so that the core may be driven at either one of two speeds. The machine Exhibit T I found had a low speed of about 13 revolutions per minute and a high speed of about 130. The stanchion 41 has at the top a vertical guideway 43

in which a cross head member 61 is vertically adjustable by means of a hand wheel 60. This cross head member carries a pair of depending arms between which is mounted the stock roll 66 and the tension roll 68. On the shaft of the tension roll is a brake mechanism 72, 73 adjustable by a weight 74 movable on an arm 75. As this machine operates and as set forth in the patent, Plaintiff's Exhibit 3, this tension mechanism is adjusted so as to stretch the fabric centrally, thereby largely conforming it to the core by the act of stretching. In order that this stretching may be effectively done, the position of the stock roll and tension roll with respect to the tire is adjusted by the hand wheel 60 so as to be as close to the core as is feasible without pinching the hand of the workman. The specification of the patent points out that, by virtue of this stretching, it is unnecessary to have any tread roller to shape the fabric over the tread portion of the tire and the machine is accordingly not provided with such a tread roller or with any other means other than the stretching for shaping the fabric and laying it smoothly onto the tread portion. The specification lays great stress on this matter of stretching the fabric and refers to it a number of times. Thus at page 5, line 30, the specification says,

> "As the shaft 8 is rotated, it will, in turn, rotate the core 104 drawing the friction-fabric off of the stock roll 66, and stretching the latter tightly about the periphery of the core 104. It will be seen that in preparing for this operation, the resistance on the roll 68 may be varied so as to get exactly the desired amount of stretching in the friction fabric on the periphery of the core; and that this stretch or tension will be exactly uniform throughout the circumference of the core, and may be much greater than that possibly attained by the strongest operator."

The same matter is referred to again on page 5, lines 62, 87, and 107, and again at page 6, lines 14, 96, and again at page 7, line 25, where it is said,

> "We have found that the mechanism described for stretching the fabric on the periphery of the core is so efficacious that the necessity for having a roll for forming the fabric in this part of the core is obviated."

It thus appears that the fundamental idea of means upon which the Thropp machine is built is that of stretching the fabric so greatly at its centre as to very largely effect thereby the shaping of the fabric to the core.

The mechanism for spinning the fabric down against the sides of the core to the inner edge is seen at the right in Fig. 1, mounted on a bracket 85, and as constructed on the machine Exhibit T, is seen more in detail in Fig. 14. I may say that the patent shows two arrangements, one in which the spinning wheels 132 are driven by independent electric motors so that their speed may be determined independently of the motion of the core, and the other the simpler arrangement shown in Fig. 14, in which the spinning wheels act in the usual way in spinning operations, namely, are driven by contact with the surface being spun.

Looking at Fig. 14, it will be seen that there are two spinning wheels 132 arranged to operate one on each side of the central plane of the core. These are mounted on arc shaped slides 122 adjustably mounted on arc shaped guides 97. These guides are given the form of the arc of a circle having the working edge of the spinning wheel as its centre and by shifting the slides 122 upon these guides, the workman changes the angle at which the wheels bear upon the core without changing the position thereof against the core.

The arc shaped guides 97 are pivotally mounted at 98

to swing toward and from the tire core like the jaws of a pincers. Each of these guides 97 has a rearwardly extending arm 108 arranged so that by means of a crank disk 111 and adjustable connecting rods 118 the two spinning rolls may be simultaneously adjusted toward or from the tire core by the manipulation of a hand wheel 117. If desired, however, the workman by loosening the connection 118 whereby the connecting rods 110 operate, may free the control of the spinning rollers in this respect from the control of crank disk 111 and they will then automatically be pressed toward the core by weights 103 acting by means of cords 101 and pulleys 102, as seen in elevation in Fig. 5. By this means the spinning wheels are swung toward the core with a constant force no matter whether they are working on a part of the core of large diameter or a part of small diameter, and the fabric is pinched against the core with uniform pressure at all points, thus the spinning wheels can automatically conform to the shape of the core so far as concerns their operation.

The spinning rolls and their mountings, as just described, are mounted on a traveling slide 85 traveling on the bracket 83. It is arranged so that the spinning rolls will be automatically fed radially inward by a sprocket and chain drive 92, 93, and gears 89, 90 and a clutch 94, 95. When this clutch is engaged the driving connection is established and, the machine being in high speed gear, the spinning wheels are automatically moved radially toward the centre of the core. At the same time the weights automatically draw the wheels toward the core, so that the whole operation of spinning down the side is automatic, and the workman only has to shift the slide 122 appropriately to keep the spinning wheels acting perpendicularly to the surface of the fabric while pinching it against the core. If, however, the machine is running in low speed, then the spinning rolls will not be

moved because they are driven only from the high speed gearing. Means are provided so that when the spinning wheel reaches the inner edge of the fabric or reaches the bead the automatic feed will be automatically discontinued and this point at which the feed shall cease to act may be selectively determined by the operator so that the spinning rolls will not displace the bead or come against a portion of the core where there is no fabric and where an accident to the machine might result.

The machine is also arranged so that, at the pleasure of the workman, clutch 94 may be disengaged and the radial feeding of the spinning roll be done by hand. For example, in spinning the fabric down around the bead core 165, when the wheels are in the position shown in dotted lines in Fig. 14, the workman would disconnect the clutch 94 thus throwing out the automatic feed and would tighten the clamps 118 and then, by simultaneously manipulating the hand wheels 88 and 117, he would cause the fabric to be smoothly applied around the bead cores 165 simultaneously.

The means for placing the bead in the machine are the same as those shown and described in the patent by reference to Figs. 10, 11, 12, and the mechanism for trimming is the same as that shown in Figs. 1, 8 and 9. As I do not understand, however, that these are of particular interest herein, I will omit description of them.

Briefly summarizing, the Defendant's machine is one having and using means for stretching the fabric so as to largely shape it to the core and lay it so tightly thereon that no tread roller is necessary. The fabric is then pressed against the core all the way to the inner edges by spinning rollers operating substantially at right angles to the surface of the core at all points and not at a receding angle and the rollers are uniformly pressed against the core to pinch the fabric closely in contact therewith and are automatically fed radially inward.

I therefore find the defendant's machine Exhibit T is an automatic machine for carrying out in an automatic way the process which the workman would use in the hand building of tires and that it does not employ either the mechanism or the plan of operation which I understand is set forth and contemplated by the State patent. Thus, unlike the State patent as I understand it, Defendant's machine stretches the fabric on the core at such a tension that it is conformed thereto and a tread roller is unnecessary. The spinning rolls do not act at a receding angle in a bend or bight in the fabric, but are pressed heavily against the core automatically through weight actuated mechanism and maintained at right angles to the core whereby the fabric is pinched against the core. It will thus be seen that the mode of operation shown in Figs. 12 to 12C of the State patent does not occur in the Thropp machine. Also I note that all of the mechanism mounted on the table 85 at one side of the machine has to do with the spinning roll, that the bead placing mechanism is arranged concentric of the core and that the trimming mechanism is arranged at the left of the machine as seen in Fig. 1, and that these are not necessarily limited to successive action, but may be all simultaneously in co-operative position; and indeed in the use of the machine the spinning is done commonly on the outer layers of the fabric while the bead placing ring mechanism is still in place. The spinning rolls and the bead placing mechanism thus co-operate to enable the fabric to be placed against the bead and the beads against the fabric with exact determination and maintenance of the proper relation so that the strains on the fabric involved in holding the beads are equalized with the beads in exact position and there is no tendency, therefore, to displace them. Thus a tire more symmetrical in its strain resisting properties is secured. How this may be done may be easily seen from an examination of Figs. 10 and 11 of the

patent, Plaintiff's Exhibit No. 3. Also the defendant's machine does not employ the high speed provided in the State patent but uses a very much lower speed, namely, only about 130 revolutions per minute, instead of 207. The State patent sets forth the view of State that he has "discovered" that it is not only possible but highly desirable to operate by his plan at a "much higher speed say at 207 turns a minute", and that by so doing more work and better work is done. It is apparently upon this discovery that the very lightly stretched fabric indicated in Fig. 12 is shaped by rollers acting in the bight as shown in Figs. 12B and 12C. Defendant's machine, as I understand it, does not utilize this discovery but operates by pinching the fabric against the core as was done in hand building except that the spinning roll is kept at right angles to the core, as stated in the specification of the patent 1,119,326, page 6, line 108. It operates, therefore, at a lower speed and in a different manner. It would, I believe, be wholly erroneous to say that the fabric is in any way stretched radially by the action of invisible fingers or that the rollers act in the bight of the fabric so formed.

Q. 63. Do you find any justification in the State patent in suit for the statement made by plaintiff's expert Browne when describing the patent in suit, which statement is as follows:

> "The core is rotated slowly by power until a single layer of fabric has been passed completely around it. Then the core is stopped and the canvas is severed by the workman who fastens the last end of the canvas so as to slightly overlie the leading edge, the rubber compound with which the canvas is provided ensuring the adhesion of these overlying ends.
>
> At this stage the fabric is stretched at its middle so as to conform to the tread zone of the core and its margins or skirt portions are unattached and are no longer flat, but are in a loose, baggy condition."

A. I do not. The State patent contains no statement which would of itself seem to convey any such meaning, while, on the contrary, Figs. 12 and 12A show the fabric as not "stretched so as to conform to the tread zone of the core", but as shaped thereto by the tread roller, and the specification of the patent states that these figures show "the fabric in different stages of application" (page 2, line 45). It also expressly says that the tread roller is a "tread forming" roller and that its action is "to shape and smooth the tread portion of the fabric against the outer periphery of the ring core" (page 6, lines 122, 87 and 60). It seems to me, therefore, that Mr. Browne is mistaken and that there is no warrant in the State patent for assuming that the State machine operates or is intended to operate in the way that he describes. State in the very early part of his specification seems to set forth a discovery of his own as to a mechanism operating at "a much higher speed", and by virtue of this speed acting on the fabric in a way which he is at pains to illustrate by a series of four figures which contradict Mr. Browne's assumption.

Q. 64. I call your attention to the evidence of Mr. Browne with respect to the alleged result of circumferential and radial stretching which he imputes to the State method of operation; and particularly to his assertion as to the change in shape of the interstices of the fabric so that the said interstices are diamond shaped on the periphery with the long dimension parallel to the periphery and are diamond shaped on the sides with the long dimension lying radially. This testimony he illustrates by means of diagrams entitled "Original flat fabric before shaping" and "Fabric shaped to Core"? What have you to say as to whether or not that phenomenon results in the operation of the defendant's machine, Exhibit T?

A. Certainly not always, and so far as I have any information it does not at all. Of course an elongation

of the mesh where the fabric is stretched over the tread portion is inevitable as a result of the stretching, but I have never seen or been able to ascertain from anyone else that there is any distortion of the fabric meshes on the sides into diamonds having the longest dimension radial. I have carefully examined the fabric after being fully applied to the core by defendant's machine, but have not been able to detect any such action with the aid of a magnifier intended for examining the fabric and with a focal length of a little over one inch. This glass shows the elongation of the meshes on the tread due to stretching, but it does not show any radial elongation at any portion of the fabric.

Q. 65. In the operation of defendant's machine, are troublesome longitudinal wrinkles or creases formed in the fabric while it is being drawn on the core which must be gotten rid of by a tread roller or otherwise, as stated in the State patent in suit?

A. They are not.

Q. 66. In the defendant's machine, are the core and spinning rolls, and connected parts, constructed and coordinated for shaping and applying a previously unshaped sheet fabric strip to that part of the core beyond the tread portion?

A. I would not say so. The fabric is certainly very largely shaped by the stretching process before it is applied to the core.

Q. 67. In the Defendant's Machine, do the spinning rolls, in their radial movement act upon the centrifugally thrown out fabric?

A. I do not understand that language as properly describing the operation of the defendant's machine. The rollers in defendant's machine act against the core to pinch the fabric between their edges and the core. Of course in moving radially inward while acting at right angles to the surface of the core, they act to draw in

279

the fabric which has not been previously applied, but there is no action directly upon the centrifugally held out fabric by acting in the bight, as shown in the State patent. The action is, on the other hand, against the core, as in hand spinning

Q. 68. In the machine of the State patent in suit, is the spinning roll support mechanically mounted to ensure its radial movement with a gradual advance in proper relation to the fast rotating core?

A. It is not. On the contrary, if in the operation of the State machine there is ever a gradual advance in proper relation to the rotating core, it is in spite of lack of any such means in the machine, and solely due to skill and judgment on the part of the operator, for there is no mechanism in the machine for ensuring any advance whatever, certainly none for ensuring that advance in proper relation to the rotating core.

Q. 69. I meant to ask you one more question with regard to the machine of the Belgian patent, and will ask it now: Will you state whether or not that machine operates to apply the fabric to the core if the action of the reciprocating rollers 30 be entirely omitted?

A. Yes, the machine operated satisfactorily with the action of the rollers 30 omitted, the fabric being properly stretched on the core.

Mr. Seward: I offer in evidence certified copy of the File Wrapper and Contents of the State patent in suit, with the request that it be marked "Defendant's Exhibit U, State File Wrapper."

Adjourned to Tuesday, July 8, at 10.30 A. M.

NEW YORK, July 8, 1919, 10.30 A. M.

Met pursuant to adjournment.

Present: Parties as before.

EXAMINATION OF MR. WATERMAN CONTINUED:

Q. 70. Did you examine last week, on July 2nd, Plaintiff's Exhibit No. 2, State Machine? If yes, will you please describe the gearing arrangement for producing the high and low speeds of the core, and compare the same briefly with the gearing shown in State's patent in suit?

A. I did. The machine in general form and arrangement was similar to that shown in the State patent, the only notable differences being in the gearing. Referring to Figures 3, 4 and 5 of the State patent, I will use the reference numerals thereon to designate the several parts to which I shall refer. The core shaft 90 is geared to the clutch shaft 70 by a pair of gears 88, 89, having respectively 58 and 30 teeth, the arrangement being substantially as shown in Figure 5. In the Machine Exhibit No. 2 there are reduction gear arrangements corresponding to 75, 76 and 82, 83 in position but the gears are not the same either in construction or function. Thus the members corresponding to the worm 76 and worm wheel 75 are in Exhibit No. 2, a pair of spiral gears which furnish the high speed drive instead of the low speed drive as Mr. Browne interprets the State patent. The centre distances of these gears appear to be 5 1/4 inches and there are 20 teeth on the gear occupying the position of the worm 76 and 32 teeth on the gear occupying the position of the worm gear 75, giving a ratio of speed reduction of 1.6 instead of a step up ratio of 1 to 1.15, as required by Mr. Browne's interpretation of the State patent.

Conversely, the worm 82 and worm wheel 83, instead

of being a high speed drive, as assumed by Mr. Browne, constitute the low speed drive, the worm being a single thread worm, and the wheel having 38 teeth, giving a speed reduction of 1 to 38.

The sprocket and chain mechanism corresponding to 79-80 of Figure 3 of the patent drives the slow speed shaft of Exhibit No. 2 at a lower speed than the high speed shaft, the ratio apparently being 3 to 2, there being 24 teeth on the large sprocket and 16 on the small sprocket.

Thus it appears that the high speed shaft of Exhibit No. 2 is that directly driven from the power shaft instead of that indirectly driven as in Mr. Browne's interpretation of the State patent. The low speed shaft 78 is driven at a reduced rate from the high speed shaft instead of the reverse as in Mr. Browne's interpretation of the patent and for the high speed drive the worm and worm wheel have been replaced by a pair of spiral gears.

The supporting arms for the spinning wheels are pressed toward the core by a pair of spiral compression springs instead of by the leaf springs 145 shown in Figure 9 of the State patent.

Q. 71. Will you state whether or not there were any name plates on the machine, and, if yes, recite their inscription?

A. There were two name plates on the machine. One said "Manufactured by The Goodyear Tire & Rubber Company, Akron, Ohio, U. S. A. patented June 14, 1904, patented November 30, 1909"; the corner of this name plate was broken but there appeared the following "ial No. 1" which I assume was originally "Serial No. 1".

The other name plate said "Machine No. 80-46 The Goodyear Tire & Rubber Co. Akron, O."

Q. 72. Will you state whether you took the high and low rotative speeds of the core, and if yes, what they were?

A. The low speed was about 6 1/2 R.P.M. and the high speed about 230 R.P.M., under the conditions of power supply existing at that time.

Q. 73. Did you see a layer of fabric spun down on the core while rotating at about the high speed you have just mentioned? Did you find a part of this layer smoothly applied to the core; and did you examine the threads in the smoothly applied part to observe their relative angularity? If your answer to the foregoing is affirmative, will you briefly describe the relative angularity of the threads of the fabric, having in mind Mr. Browne's description of this matter given in his direct testimony?

A. I did. The meshes of the fabric on the tread portion were apparently of lozenge or diamond shape with the long axis circumferential, that is in the rolling plane of the tire. The meshes at a certain mean radius appeared to be square and in the portions of smaller radius the meshes appeared to have taken a diamond shape with the long axis radial. The change of form was slight but perceptible.

Mr. Seward: Defendant's expert has not been given a demonstration of Plaintiff's Exhibit No. 2 State Machine, in the operation of building a tire carcass for the purpose of his testimony in this case.

Direct-examination closed.

Mr. Rogers: Plaintiff's Counsel inquires if it is understood that Mr. Waterman will be produced for further cross-examination, if requested by Plaintiff's Counsel, in connection with the Mathern Belgian patent, Defendant's Exhibit F; the Mathern German patent, Defendant's Exhibit O; and the Machine of Mathern Belgian patent, Defendant's Exhibit H, at a later period after October 15, 1919, and before Plaintiff begins his rebuttal evidence.

Mr. Seward: It is so understood; with the further understanding that Counsel for plaintiff shall now proceed with such cross-examination as he may wish to have concerning the remainder of Mr. Waterman's direct testimony.

Mr. Rogers: Upon the understanding as stated, Plaintiff's Counsel waives other cross-examination.

Signature waived.

Notary's certificate waived.

Adjourned to a time and place to be agreed upon, the date being not earlier than October 15, 1919.

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Plaintiff,

vs.

THE JOHN E. THROPP'S SONS CO.,
Defendant.

} Equity No. 614

Defendant's Testimony.

Testimony taken on behalf of Defendant before EDWARD O'BYRNE, Special Master, at the office of the Clerk, United States District Court, Trenton, New Jersey, beginning on Friday, June 27th, 1919, at 11:00 A. M., pursuant to notice and agreement of counsel.

APPEARANCES.

ROBERT FLETCHER ROBERTS, Esq., and
LUTHER E. MORRISON, Esq.
for Plaintiff.

E. CLARKSON SEWARD, Esq.
for Defendant.

THOMAS A. WALCH a witness called in behalf of Defendant, being duly sworn, testifies as follows:

DIRECT-EXAMINATION BY MR. SEWARD:

Q. 1. Please state your name, residence, occupation?

A. Thomas A. Walch, Trenton, N. J.; Foreman of the Tire Manufacturing Department of Ajax Rubber Company of Trenton, New Jersey.

Q. 2. How long have you been with the Ajax Company?

A. Thirteen years.

Q. 3. Where was the Ajax Company located when you first went with it?

A. 106th Street, New York; East River between First Avenue and the River.

Q. 4. What year was that?

A. 1906.

Q. 5. What kind of work did you do with the Ajax Company in 1906?

A. Made tires by hand.

Q. 6. Please describe how you applied the fabric to the core, telling us how the core was mounted and the operations you went through?

A. Well, we had three and four prong spiders; we would have a slot in the core and we would put it on this spider; then we had a wrench to tighten it up with screws on the top—adjustable screws; you could turn it until you got it tight enough; then we mounted the core and put a little cement across the top and all around the side, about half way of the core; then we started our fabric and started to pull it on just as hard as we could, cut it off and spliced it; and then we would start and turn our core around just as fast as we could, and then we would take this stitcher, three inch stitcher they called it, a steel stitcher, about a sixteenth of an inch on the point, and we would go right in like that (indicating) toward the bead and the same on the other side.

Q. 7. When you say "the same on the other side", do you mean on the other side of the core?

A. Yes.

Q. 8. Did you hold the stitcher in one hand or in two hands?

A. Two hands.

Q. 9. What position did the edges of the fabric take when you turned the core as fast as you could?

A. Well, it stuck out, just like that (indicating) laid out.

Q. 10. Did you do this yourself?

A. Yes, sir.

Q. 11. Are you sure it was in 1906?

A. 1906.

Q. 12. You said the Ajax Company is now in Trenton; when did it come to Trenton?

A. 1906. I came to Trenton October, 1906, but I was one of the first ones to come; there was only half of the company came then, but I was one of eight that came over here.

Q. 13. You started working for the Ajax in Trenton in October, 1906?

A. Yes.

Q. 14. Coming from New York?

A. Yes, sir.

Q. 15. State whether or not you continued the operation you have just described after you came to Trenton?

A. Yes; I continued it all the time after we came to Trenton. I was making tires for five years and always done it that way, by hand.

Q. 16. Did you see any other men following this same operation when you were in New York?

A. Oh, yes; several of them.

Q. 17. Did you see any others in Trenton?

A. Oh, yes; most all of them in Trenton.

Q. 18. How long have you been foreman of the Tire Making Department of the Ajax Company?

A. Eight years.

Mr. Seward. Direct examination closed.

Cross-examination by Mr. Rogers.

x-Q. 19. You say that several of the employees of the Ajax Company in New York followed the same method of making tires that you did, namely the one that you have described?

A. Yes, sir.

x-Q. 20. What other method of making tires by hand was used by the Ajax Company in New York?

A. Well, some of them, when they first started, would use a spade, a wooden spade.

x-Q. 21. Did they spin the fabric down on the core in the way that you did it?

A. No, not with the wooden spade; you had to have it stationary; went all around it and took much longer to do it.

x-Q. 22. Most of the men did it?

A. Yes, sir.

x-Q. 23. With the spade?

A. No; with the stitcher.

x-Q. 24. Well, with spade or stitcher?

A. Well, the new fellows that would start in, they would always do it with the spade starting in, because it was quite a knack to do it with the stitcher. We learned a lot of new men there and they did not quite get the knack of doing it right away.

x-Q. 25. When they used the spade in the manner described, the spade was worked in and out?

A. Yes, like that (indicating).

x-Q. 26. Somewhat in the manner shown in the sketch I show you, Plaintiff's Exhibit No. 7.

A. Yes; like that (indicating).

x-Q. 27. I suppose the quality of tires and their durability has materially improved in the last thirteen years, has it not? I am speaking of fabric tires, not cord tires.

A. Well, we use the same kind of fabric, very near the same kind of compound. I don't know as they have durability any better. I believe the hand made tire was considered just as good as far as durability goes as a machine made tire.

x-Q. 28. Did they get as good mileage out of these hand made tires in 1906 as they do out of machine made tires today?

A. Yes, sir.

x-Q. 29. What mileage did they get out of a hand made tire in 1906?

A. Well, they were guaranteed five thousand miles.

x-Q. 30. Even in 1906?

A. 1906, yes, the same as they are today.

x-Q. 31. How many tires a day could you make by the spinning method which you employed? I am speaking of you personally.

A. Well, it depends upon the size of the tire. The three inch tires we would make probably eight in ten hours and the four inch tires we would do five in ten hours; four and a half and five inch, why we would do, well, three and four sometimes. It depends on the man himself. Of course there were fast and slow men, but the one that used the stitcher was the fastest.

x-Q. 32. How does the Ajax Company make its tires today?

A. Well, by hand and machine both. They make all cord tires by hand and the fabric tires by machine.

x-Q. 33. What machine does the Ajax Company employ for the making of fabric tires?

A. The Thropp machine.

x-Q. 34. While you were spinning down the fabric on the side of the core, under the hand spinning method, did the core ever stop rotating?

A. Oh, yes; once in a while you would have to start it up again.

x-Q. 35. I suppose that depended to some extent on the speed that you originally gave to the core?

A. Yes, sir.

x-Q. 36. And I suppose also to some extent on the amount of pressure you applied to the side of the core?

A. Yes, sir.

x-Q. 37. Have you any idea how great that pressure was with which you applied the stitcher to the side of the core?

A. Well, it was not a great pressure—just enough to stick the fabric to the cement; there was some on the inside, just to touch the fabric, very little pressure.

x-Q. 38. I suppose if you applied a higher degree of pressure there was a liability that the stitcher would slip?

A. Yes; you had to gauge your stitcher; that is, guide it very good.

x-Q. 39. I suppose that sometimes when the stitcher struck the splice or overlapped end of the ply, that it jumped.

A. Well, very little. You would have hold of it with your two hands to guide it very good, and your laps go up like that (indicating) and it could not move anyway.

x-Q. 40. Well, it did jump sometimes?

A. Well, sometimes, when it would strike a splice, but it did not jump far enough to do any harm.

x-Q. 41. What would you do when these occasional jumps occurred?

A. Well, we would make the tire just the same; it would be stuck just the same; I just held the stitcher and let it go right on.

x-Q. 42. You say the pressure which you employed was a very light pressure?

A. Well, yes, not to amount to anything; you had to hold the stitcher steady; that is the way you held it, the pressure, you didn't have to put on much pressure at all.

x-Q. 43. You said the fabric stuck out. I suppose you mean by that that the skirts of the fabric stood out from the sides of the core because of the centrifugal force; is that what you mean?

A. Yes.

x-Q. 44. Did it stand out to the same extent as it does in the machine that you are now employing?

A. Yes. Still the machines now, sometimes they will tuck it; it don't have to stand out.

x-Q. 45. Have you any idea how fast the core rotated when you were making tires by hand?

A. Well, no; I have no idea.

x-Q. 46. I suppose the amount of fabric that would stick out depended more or less upon the speed of the core, didn't it?

A. Yes, sir.

x-Q. 47. Did you ever try to spin both sides of the layer, ply, down at one time?

A. Oh, no; you would have to have two stitchers, you could not hold it.

x-Q. 48. You never tried to spin a tire with two stitchers, one on each side?

A. No. I am talking about hand spinning operation.

x-Q. 49. What percentage of stretch does the Ajax Company now use in applying the layer originally to the core?

A. Six per cent.

x-Q. 50. And what was the corresponding percentage of stretch when you made tires by the hand spinning method?

A. Six per cent.

x-Q. 51. Are you aware that tires are made with a considerably higher amount of stretch than that—I am talking about other companies.

A. I have heard that they do, but I have not worked at it in factories, only the Ajax for the last thirteen years.

x-Q. 52. In other words your experience is confined entirely to the Ajax practice?

A. Yes, sir.

x-Q. 53. Do you think the speed of rotation that you gave the core by hand was as great as that now present in the operation of the Thropp machine? Do you understand the question?

A. Yes. Well, it is very near the same; there was not much difference; you can twist the core just as fast as the Thropp machine.

x-Q. 54. As I understand it, the speed of the core when you were spinning by hand depended on the way you originally spun the core?

A. Yes, sir.

x-Q. 55. And of course that original speed of rotation grew less and less and less?

A. Yes.

x-Q. 56. Now, what did you mean in saying that you thought the speed of rotation at that time was practically the same as that of the Thropp machine now; do you mean that the original speed of the core was the same or the final speed?

A. When you would start it off; of course, it would die out a little. Of course, if you did not get both sides down, why you would have to start up again.

x-Q. 57. You did not spin the core while you were holding the stitcher against the side of it?

A. No; no.

x-Q. 58. In other words, when the core died down you would spin it again and then start over again with the stitcher?

A. Yes, sir.

x-Q. 59. Will you kindly explain what you meant by tucking the fabric, in answering x-Q. 44?

A. Well, some men tuck it in and others let it stand out; just as they feel like doing; it makes no difference.

x-Q. 60. How do they tuck it in?

A. Just push it with their hand like that (indicating) before they start up the machine.

x-Q. 61. You mean that when the skirt started to flare out, the operator would force it in?

A. On the machine, before they put the stitchers on; some operators let the skirts flare out and others tuck it down on the sides of the core with their hands before the core is speeded up.

x-Q. 62. And then I understand you mean that when

the fabric has been tucked in in this manner, and the core is started to rotate, that it will not fly up?

A. No, sir; it won't fly up.

Mr. Seward: No redirect-examination.

Deposition closed.

Signature waived.

TALCUT I. CURTIS, a witness called on behalf of the Defendant, being duly sworn, testifies as follows:

DIRECT-EXAMINATION BY MR. SEWARD:

Q. 1. Please state your name, residence, and occupation.

A. Talcut I. Curtis, Trenton, New Jersey; demonstrator of the Thropp tire machinery and equipment.

Q. 2. You are employed by the Delaski & Thropp Circular Woven Tire Company of Trenton?

A. Yes.

Q. 3. When were you first employed by that concern?

A. 1905.

Q. 4. What did you do for that concern in 1905?

A. Made tires for them.

Q. 5. Made them by hand?

A. Yes.

Q. 6. Just describe how you put the fabric on the core in making those tires in 1905.

A. We mounted the core on a three pronged spider stand, cemented the core, stretched the fabric on, spliced it, and then rolled it down with a three inch stitcher, rolling stitcher.

Q. 7. State just how you operated when you rolled it down; just describe what you did.

A. The rolling down I did in two ways; First, holding the stitcher with both hands, by rotating the core first, holding the stitcher with both hands, going down one side and then down the other side.

Q. 8. When you say "down", in which direction do you mean?

A. Toward the center of the core; toward the inside circumference.

Q. 9. What was the other way in which you rolled it down?

A. The other method was in revolving the core with the left hand and stitching down with the right, turning the core from the other side—spinning it down.

Q. 10. In the second method, as I understand you, you rotated the core with the left hand?

A. Yes.

Q. 11. At the same time that you held the stitcher in with the right hand; is that correct?

A. Yes, that is correct.

Q. 12. How did you rotate the core in this first method?

A. Why, start the core rotating and get it up to speed, and then hold the stitcher with both hands and go down and right along.

Q. 13. When the core was rotating in the first method what position did the edges of the fabric take?

A. The edges flared out to a certain extent according to the swiftness of the core.

Q. 14. You mean by "swiftness" speed of rotation?

A. Yes; according to the speed of the core.

Q. 15. Did you ever follow that first method in any other factory?

A. Yes.

Q. 16. Where did you first do it after 1905 with the Delaski & Thropp Company?

A. I did it at the Empire Plant, Trenton, New Jersey.

Q. 17. What year?

A. I think that was 1906.

Q. 18. What position did you hold in the Empire then?

A. I was building tires at the time.

Q. 19. Did you subsequently hold any other position there?

A. Yes, sir; I was foreman afterwards.

Q. 20. When did you leave the Empire?

A. I left the Empire in May, 1909.

Q. 21. Then where did you go?

A. I went with the Batavia Rubber Company, Batavia, New York.

Q. 22. Did you make any tires there?

A. Yes.

Q. 23. How did you put the fabric on the core at the Batavia Company when you first went there?

A. By the same method.

Q. 24. Do you mean by the first method mentioned by you?

A. Well, both ways I mean.

Q. 25. In what year did you do that at the Batavia Company?

A. 1909, and 1910.

Q. 26. You came back to the Delaski & Thropp Circular Woven Tire Company about when?

A. About the first of the year, 1911.

Q. 27. And have been with that company ever since?

A. Yes.

Q. 28. When you state that you are a demonstrator of the Thropp equipment, do you mean of their tire machinery?

A. All of their tire equipment.

Q. 29. Just state what positions you have held in different tire factories.

A. The position at the Empire when I left there, I was foreman, and I was inspector at the Batavia Rubber Company when I left there.

Mr. Seward: Direct examination closed.

CROSS-EXAMINATION BY MR. ROGERS:

x-Q. 30. I understand that you demonstrate the Thropp Tire making machines; is that correct?

A. Yes. I break men in to run the machine in new factories when they put the machine in.

x-Q. 31. When was it that you first made tires by the hand spinning method?

A. In 1905.

x-Q. 32. How do you fix that date?

A. Because that is the time that I worked for the Thropp Company making tires.

x-Q. 33. Was that the only method you had employed in tire making by hand?

A. No, sir; I have used the spades also—the wooden spades.

x-Q. 34. Was that before or after you used the hand spinning method?

A. Well, I used, sometimes the spade at that time. We used them both possibly at that time, some. Some fabric is stiffer than others and so on, and they changed over to the other methods possibly a little.

x-Q. 35. When you speak about the spade method I take it you refer to a method which is illustrated, so far as the path of the tool is concerned, in plaintiff's exhibit number seven?

A. Yes.

x-Q. 36. Referring again to this plaintiff's exhibit number seven, did you ever use a stitcher instead of a spade in the same way?

A. No; I never used anything but the spade in this way.

x-Q. 37. What kind of fabric did you use the spade on in the saw-tooth method illustrated in this exhibit number seven?

A. We used a spade at the Thropp Company for the circular woven fabric.

x-Q. 38. When was that?

A. That was in 1905.

x-Q. 39. Will you kindly explain what kind of fabric you used the saw tooth method on at that time?

A. In connection with a circular woven band. This fabric was cut off in suitable lengths and joined together at its ends to make an endless band. When I say "circular woven fabric" I mean one in which the inner warps were shorter than those at the outer periphery, thereby tending to give the fabric normally a circular shape.

x-Q. 40. Was this the first tire making that you did?

A. At Thropps was the first, yes.

x-Q. 41. Was the first hand tire making that you did in connection with this circular fabric that you have been describing?

A. That was my first tire building.

x-Q. 42. How long did you work in that way?

A. I was at Thropps from about Spring to the late fall of 1905, and during that time I worked on these tires all the time.

x-Q. 43. And then where did you go?

A. I went to the Globe—the United & Globe Rubber Company's plant at Trenton.

x-Q. 44. Did you make tires there?

A. I did not make tires there.

x-Q. 45. How long did you remain in that position?

A. I think I was there until the spring of 1906 and then I went with the Empire people on tires again.

x-Q. 46. How long did you stay with the Empire Company?

A. I left there May 29th, 1909—about three years I was there.

x-Q. 47. And when did you first make a tire by the hand spinning method that you originally described?

A. I first made a tire spinning the fabric down at Thropps during the year 1905.

x-Q. 48. Perhaps I misunderstand you. Did you not say that during 1905 period with Thropps you worked on circular woven stuff?

A. I did, but we made these tires, quite a few of them, putting on a ply of regular fabric instead of this circular weave for some tires, and those are the tires that I used the spinning method on.

x-Q. 49. Then, when you originally used the spinning method it was only on certain plies of the tire, is that correct?

A. Yes, the band ply.

x-Q. 50. The band ply?

A. The first that goes on the core.

x-Q. 51. In other words you merely laid down the first ply by the spinning method and then subsequently used the circular woven plys?

A. Placed the circular woven over that and spaded that down.

x-Q. 52. When did you first make a tire entirely by the hand spinning method, I mean, wherein all of the plies were spun down?

A. At the Empire.

x-Q. 53. And when was that?

A. That was between the Spring of 1906 and 1909 when I left there, mostly during 1906. After that time I was foreman and I did not build any tires myself personally.

x-Q. 54. Was that the general practice of the Empire Company?

A. Yes.

x-Q. 55. They made all of their tires by the hand spinning method?

A. Some of them, not all of them. Some of the men could not spin it down and used the spade all the way through—some of them.

x-Q. 56. Why could they not spin it down?

A. Well, they had not got used to it,—new men, mostly—had not got to be expert tire makers enough so as to do it.

x-Q. 57. You heard the testimony of Mr. Walch, did you not?

A. Yes, sir.

x-Q. 58. I refer to the witnes who testified immediately before you.

A. Yes, sir.

x-Q. 59. Do you disagree with him in any of the statements that he made? Of course I am not asking you as to statements of fact?

A. No, I think not.

x-Q. 60. Did you ever try to spin down a tire on both sides of the core at one time by using two stitchers?

A. Not by hand, no.

x-Q. 61. What about the amount of pressure that you applied in holding the stitcher against the core; have you any way of estimating the amount?

A. Not exactly, no; just used enough to roll the fabric smooth.

x-Q. 62. You think it was uniform on both sides of the core?

A. Yes.

x-Q. 63. I suppose making tires by a machine such as the Thropp machine is considerably easier for the operator, is it not, than making them by hand?

A. It is easier and much faster.

x-Q. 64. What I particularly had in mind was that it does not fatigue the operator to the same extent, does it?

A. No; it does not.

x-Q. 65. In other words there is less exertion?

A. Yes.

x-Q. 66. What is the normal amount of stretch em-

ployed in originally attaching the ply to the core, in connection with the Thropp machine?

A. We are using about twelve per cent as a standard now.

x-Q. 67. What is the general stretch that is used by Thropp machine users?

A. It varies in different factories. Each one has their own idea in regard to stretch. It varies from what I heard Mr. Walch say up to about eighteen or twenty per cent. In fact he is the first one that I heard say they stretch six per cent. That is very little stretch. It runs to about eighteen to twenty per cent; some places use eighteen per cent.

REDIRECT-EXAMINATION BY MR. SEWARD:

Rd-Q. 68. Will you describe a little more in detail what this stitcher used in hand stitching is like; describe the tool.

A. It is a steel roller, three inches diameter, about one sixteenth of an inch thick at the edge; it is mounted in a wooden handle.

Rd-Q. 69. How is it you remember the exact day when you left the Empire Company?

A. Well, I have that on a watch here, a watch they gave me; I have it in my pocket; the date is on there; I always remember that.

Rd-Q. 70. You mean that that watch was given you by the employees of the Empire Company, May 29th, 1909?

A. Yes; when I left there.

By Mr. Rogers:

Rx-Q. 71. In other words, it was in 1909 that you left the Empire Company; is that correct?

A. Yes, sir.

Rx-Q. 72. Have you any similarly good evidence to indicate that you came to the Empire Company in the spring of 1906?

A. I am not positive of the date of that.

By Mr. Seward:

R-rd-Q. 73. What do you say you are not positive of the date of?

A. I know I was there in 1906, but I do not know just the date; just the date I could not remember.

By Mr. Rogers:

R-x-Q. 74. But you have not any documentary or other evidence like the engraved watch, for instance, to prove that you came to the Empire Company in 1906?

A. No.

Deposition closed.

Signature waived.

IN THE

UNITED STATES DISTRICT COURT,

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Plaintiff,
vs.
THE JOHN E. THROPP'S SONS COMPANY,
Defendant.

In Equity.
No. 614.

Plaintiff's Rebuttal Testimony.

Testimony taken on behalf of the plaintiff, pursuant to notice and agreement of counsel, before CHARLES J. CAREY, a notary public, at the Statler Hotel, Cleveland, Ohio, beginning on Wednesday, July 7, 1920, at 11 o'clock A. M.

APPEARANCES:

ROBERT FLETCHER ROGERS and LUTHER E. MORRISON, Esqs., for plaintiff; and
E. CLARKSON SEWARD, Esq., for defendant.

Whereupon WILL C. STATE, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers deposes and says as follows:

Q. 1. Please state your name and residence.
A. Will C. State; Akron, Ohio.
Q. 2. You are of legal age?
A. I am.

Q. 3. You are in the employ of The Goodyear Tire & Rubber Company, of Akron, Ohio?

A. I am.

Q. You are the originator of the Goodyear commercial machine for the manufacture of fabric carcasses for tires, are you not?

A. I am.

Q. 5. How long have you been in the employ of the Goodyear Company?

A. 19 years the 7th of May.

Q. 6. How long has the Goodyear Company been manufacturing automobile tires, if you know?

A. Since about 1903.

Q. 7. How were these fabric tires made originally,—by machine or by hand?

A. By hand.

Q. 8. Will you kindly briefly describe this hand method of making tire carcasses?

A. First ply drawn on a core by hand, stitched down; second ply drawn on—or stretched on, stitched down in the same manner; bead applied; third ply was drawn on by hand, or stretched on by hand, stitched down over the bead; fourth ply in like manner.

Q. 9. You say plies were drawn or stretched on to the core. Was there a considerable degree of stretching involved in this operation, or not?

A. The stretch was not considerable. It was medium.

Q. 10. Can you approximate the percentage of circumferential stretch used in that hand method?

A. About 12 per cent.

Q. 11. This step that we have just been discussing is the so-called "circumferential stretching", is it not?

A. Yes, it is.

Q. 12. Now, will you kindly say how the plies were stitched down on to the core? I mean by that the portion

of the ply that was not caused to adhere to the core by the circumferential stretching.

A. The operator would take hold of the ply, take it in his hand and start to pulling toward the center of the core; and the stitcher—he would start to stitching it down in a manner like a sawtooth,—just wipe it back and forth with the stitcher till he come down with the bead; all the time he was pulling the ply radially, until he come to the—practically to the base of the tire, and then the tendency was to take the stitcher a little sideways to rub it down over the bead.

Q. 13. You say the operator pulled the skirt of the fabric inward radially, and at the same time worked it down with a tool. What was the effect of this joint operation by the operator?

A. He would get stretch circumferentially with the tread; he would get radial stretch when he pulled it down toward the bead portion.

Q. 14. You have spoken of the "sawtooth" method. Do you mean by that that the tool was operated in a manner substantially similar to that indicated in the sketch marked "Plaintiff's Exhibit No. 7"?

A. Yes.

Q. 15. Then I understand from your description of this hand-stitching method that there was stretch in two directions, namely, the original circumferential stretch and the subsequent radial stretch; is that correct?

A. It is.

Q. 16. Do you know whether or not there was any other known method of making tires about the same time, by a different kind of stretching operation?

A. No, I do not.

Q. 17. How about later on?

A. Why, I know there were tires made. They would stretch so much on the circumference of the tread that it would practically form the tire.

Q. 18. You mean all the way down to the bead?

A. All the way down. Very little left to do.

Q. 19. In other words, then, there were two kinds of general methods of making tires: one wherein circumferential and radial stretching were both employed to shape the fabric to the core, as in the Goodyear practice; and another wherein circumferential stretch was almost entirely depended on for the purpose of shaping the fabric to the core? Is that correct?

A. It is correct. These were the only two general methods I knew of.

Q. 20. Can you tell me why the Goodyear Company made its tires with what I may term the "double-stretch" method, instead of by the "single circumferential-stretch" method?

A. We think that it made a better, uniform, balanced tire.

Q. 21. And that was regarded as superior to the single-stretch (circumferential) method?

A. Yes.

Q. 22. Now, what do you know about any early effort made by the Goodyear Company to embody this double-stretch method into a machine operation?

A. The Seiberling-Stevens machine.

Q. 23. Did you see that machine?

A. I did.

Q. 24. Do you remember about when that machine was built by the Goodyear Company?

A. Why, it was sometime—started sometime in 1903.

Q. 25. What was the general principle on which that machine operated?

A. They had a method to draw the fabric on to the core. The next operation was to change the speed a little, and had reciprocating fingers which shoved the fabric down toward the bead.

Q. 26. In other words, it used the double-stretch

method; that is to say, it attempted to draw the fabric on to the core originally by circumferential stretch, and then the fingers were used to form the unattached skirts to the core; is that correct?

A. Correct.

Q. 27. Were these jigger fingers reciprocated or moved up and down on the side of the core?

A. They were reciprocated up the side of the core.

Q. 28 Up and down?

A. Up and down the side of the core

Q. 29. Was the operation of these jigger fingers anything like the hand operation which you have described as the "sawtooth" method?

A. Yes, the jigger fingers practically took the place of the little paddle they had used to push down the fabric. They didn't have the movement that the hand tool had. I mean they did not operate at the same angle as in the sawtooth method.

Q. 30. Did these jigger fingers successfully form the fabric to the side of the core?

A. They did not.

Q. 31. Do you know whether or not any commercial tires were produced on that Seiberling and Stevens machine?

A. There was a very few.

Q. 32. And what became of that machine ultimately?

A. It was scrapped, junked.

Q. 33. In other words, as I understand your testimony, this Seiberling and Stevens machine attempted to embody the previous Goodyear practice of dividing the stretch into two distinct operations, namely, original, circumferential stretch over the tread of the tire, and, subsequently, radial stretch to form the unattached skirts to the side of the tire down to the bead; is that correct?

A. Yes.

Q. 34. You say you saw the Seiberling and Stevens machine in operation?

A. Yes, I did.

Q. 35. Can you tell me what was the highest speed of the core in that machine?

A. I would say it was about—that is, the high speed was about 30 r.p.m.

Q. 36. Now, after that Seiberling and Stevens machine was junked, what method was employed by the Goodyear Company in making its tires?

A. The same hand methods, original hand methods.

Q. 37. You mean the one previously described by you?

A. Yes.

Q. 38. And that lasted for how long a time?

A. I would say about 3 1/2 years.

Q. 39. What was the financial condition of the Goodyear Company during the period last mentioned, namely, after the scrapping of the Seiberling and Stevens machine?

A. Very bad.

Q. 40. And what was the next attempt, if any, to make a tire by machinery at the Goodyear plant?

A. I started some experiments early in 1907.

Q. 41. And did those experiments ever result in a commercial machine?

A. They did.

Q. 42. And when was that commercial machine first used for making tire carcasses?

A. The latter part of 1907.

Q. 43. Was it put on the floor in regular practice at that time or later on?

A. No, it was put on the floor early in the spring of the following year,—1908.

Q. 44. And what method of making a tire carcass was embodied in that machine? I refer to the stretch system.

A. Started out with a system to make a tire with

Q. 61. I observe these sketches are numbered. Am I to understand that the numbers give the substantial succession in point of time of your several experiments?

A. The successive steps in the experiment.

Q. 62. In other words, I understand that, if these sketches are not numbered in exact chronological order, you will state the fact when you come to describe them?

A. I will.

Q. 63. Referring, first, to the sketch marked "1st device", will you kindly tell me what it is?

A. I had mounted a core on a finishing-stand and chuck attached to worm and gear to draw the worm—to—engaged to draw on the ply; then disengage the worm, put the crank on the direct shaft, to revolve the core by hand.

Q. 64. If I understand you, then, correctly, you were able to drive the core in two ways; either through the worm, in order to get a slow speed for the core to effect the original circumferential stretch, after which you disengaged the worm and put the handle directly on the shaft of the core to rotate it more rapidly; is that correct?

A. Yes.

Q. 65. And how, in connection with this arrangement, did you stitch down the skirts of the ply?

A. I disengaged the worm, put the crank on the end of the direct shaft, had a man rotate—speed it up, and had another man to take a hand-stitcher to roll it down.

Q. 66. How high a speed, if you can estimate it, were you able to get by turning the core at the higher speed you have mentioned?

A. About 75 or 80 r.p.m.

Q. 67. And was the operation of rolling down the skirts of the ply on the core, when rotated at this speed, successful?

A. No, it was not.

Q. 68. Can you state some of the reasons for its not being successful?

A. In using the hand tool, the handspinning tool, it was hard to guide it. It would jump in and wrinkle the fabric. It didn't seem possible for it to hold it steady enough. You couldn't gauge the advance of the stitcher, you couldn't cont[illegible]; it jumped. It wouldn't stitch it down even. It would lead in just like a thread. You would miss a lot of the fabric and not roll it down. His hand off, and come in contact with the fabric; holding it with two hands, and would throw a lot of wrinkles in it, in the edge of it.

Q. 69. Was there any difficulty when it struck the splice?

A. When it struck the splice, it jumped.

Q. 70. Did you get any appreciable degree of radial stretch?

A. Very little.

Q. 71. Did you get a sufficiently high speed of rotation to throw the skirts out sufficiently by centrifugal force?

A. No, did not.

Q. 72. When you originally stretched the fabric on to the core by circumferential stretch, how was the pull of the core resisted; or, in other words, what was the source of fabric supply?

A. The fabric was cut to length; and a man held on to it, just gripped it, held back, while we drew it on.

Q. 73. I next hand you the sketch marked "2d device"; and ask you to explain the difference, if any, over the "1st device."

A. I had another stand with a roll of fabric on it, installed a brake on the end of the shaft that held the fabric, had weights to adjust the tension, and drew it on under tension to get the circumferential stretch on the tread of the core.

Q. 74. In other words, the difference between the two sketches is, that the "2d device" merely adds a fabric-

tension device for the purpose of securing the circumferential stretch; is that correct?

A. Yes.

Q. 75. And, so far as the working down of the skirts of the fabric is concerned, there was no change?

A. No change.

Q. 76. Did this tension device enable you to get better results in the direction of uniform tension?

A. It did.

Q. 77. I next hand you your sketch marked "3d device"; and ask you to point out the difference, if any, over what is shown in "2d device".

A. The "3d device" is the same as "2d device", with the exception of I put a "U" or horseshoe plate around the core, so the man could have something to rest his hand on when he tried to spin-roll it down with the hand spinner.

Q. 78. This horseshoe device that you mention appears to embrace the core rather closely. Are its proportions correctly shown in the sketch?

A. No, they are not. It was rather a large shoe or "U", and was large enough to allow the skirts to run between. It was only used, as I said before, for the man to have something to rest his hand on when he run the hand tool down the side.

Q. 79. Well, now, did this horseshoe arrangement solve the difficulties you had previously encountered in the handspinning operation?

A. It did not.

Q. 80. I suppose it did improve them to a certain extent?

A. It helped the man a little in holding the tool.

Q. 81. Were you able to get the requisite amount of radial stretch you were after by the use of this horseshoe, when the man rested his hand on it?

A. Did not.

Q. 82. I also observe in this sketch an implement marked "AA". Will you kindly tell me what that was?

A. It's a handspinning roll or tool. It has a spring to allow a certain amount of give when going over a splice.

Q. 83. What was your object in inserting this spring in the hand tool?

A. With the solid tool, it would jump—when it come to a splice, it would jump; and sometimes would jump out of his hand; he couldn't hold it against the plies on the side and advance it properly.

Q. 84. I next direct your attention to sketch entitled "4th device"; and will ask you to state what, if any, change is embodied therein over "3d device".

A. The change over the "3d device" is having it belted from a shaft, having the high speed belted from a shaft.

Q. 85. You mean that for the fast speed, the higher speed, of the core you used a belt and pulleys to shafting?

A. Yes, belt and pulleys to shafting.

Q. 86. How about the low speed to draw the fabric on to the core in this "4th device"?

A. Used the device same as in previous sketches,—the worm and the gear.

Q. 87. Now, what was your idea in attempting to drive the shaft and the core at high speed from belting, instead of by the crank as in the previous sketch?

A. Wanted to get a higher speed than a man could do it by crank.

Q. 88. Well, why did you want to get a higher speed?

A. I wanted to get the skirt of the ply to come out from the core, and to help get the wrinkles out of the skirt.

Q. 89. You mean because of the greater centrifugal force involved?

A. Yes.

Q. 90. And you mean with the hand-turned core you

could not get a sufficiently high speed to give you the centrifugal force?

A. Could not.

Q. 91. And therefore you turned to a power drive; is that correct?

A. Yes.

Q. 92. I next hand you sketch marked "5th device"; and ask you to point out what, if any, difference there is therein over what is shown in "4th device".

A. The change made was to discard the drive from the shaft and put on a belted drive from a motor.

Q. 93. And why did you change from the drive from the shaft to the motor?

A. It was easier to change the speeds with the motor than it was from a line-shaft.

Q. 94. Was it a variable-speed motor?

A. It was variable in fact, in this way: I used a simple rheostat to step it up on the speeds.

Q. 95. In other words, by the use of this motor you could change its speed so as to get the desired speed of rotation for the core?

A. Yes.

Q. 96. Referring again to this sketch, what parts were used to stretch on the fabric originally; I mean by that to get the circumferential stretch?

A. The same tension was used that drew it on with the worm gear.

Q. 97. In other words, then, the motor was not used for the slow speed?

A. No.

Q. 98. But merely to give a high speed of rotation to the core, which high speed you could regulate by the attached rheostat; is that correct?

A. Yes.

Q. 99. I next hand you sketch "6th device"; and ask you to state what, if any, change was made over "5th device".

A. I have changed from a single roll of fabric to two rolls of fabric; and the reason was, to get the first ply—or, in putting on the first ply, in crossing the second ply it would have been necessary in the "1st device" to reverse the roll, take it off and reverse it. In this one I used plies of all the same width for the four plies. Simply took off the one roll for one ply, and the second roll for the second; and reversed—come back to the first roll, put on the third ply with the first roll, went back to the second roll and put on the fourth ply; simply to cross it and not have to pull off the roll and get another roll and change it.

Q. 100. In other words, the change in this "6th device" related merely to the provision of a second fabric roll?

A. That's all.

Q. 101. And there was no change in other respects; is that correct?

A. Correct.

Q. 102. Referring generally to the last four sketches under discussion, there had been no change in the means for rolling down the skirts of the fabric on the core?

A. No.

Q. 103. And what you were working on through those four sketches was to get a proper tension device for the original circumferential stretch, and means for giving you the requisite high speed for the core; is that correct?

A. Yes.

Q. 104. I next direct your attention to "Sketch 7", and ask you to state what change appears therein over the four sketches mentioned in the last question.

A. I had taken off the "U" support for the hand-stitcher, put in an adjustable bar or rest, and mounted the spinning-rolls on a pair of tongs.

Q. 105. When you refer to the bar or rest, you mean the bar shown in plan-view and supported by the stand "R" shown in the perspective view, do you not?

A. Yes.

Q. 106. Now, the tongs you referred to are the elements marked "S", are they not?

A. Yes.

Q. 107. Now, please explain how you manipulated the tongs "S" in relation to the bar or rest you have mentioned.

A. After stretching on the ply, take the tongs in hand, press the rolls together, move them forward, rolling down the fabric on the sides.

Q. 108. Do you mean that, during this operation, the tongs were resting on the rest or bar?

A. They were.

Q. 109. And I understand that the operator took the ends of the tongs in his two hands and pressed them together, so as to cause the rolls to form the fabric against the sides of the core?

A. Yes.

Q. 110. And did he advance the tongs during this operation?

A. He did.

Q. 111. So as to bring the stitcher-rolls down to the bead portion? Is that correct?

A. Yes.

Q. 112. And how did that particular arrangement of "Sketch 7" work out?

A. Not very well. The tongs would tip up and cut into the fabric, and wrinkled it, and were very hard to hold.

Q. 113. In that "Sketch 7" the means you used for stretching the fabric circumferentially on the core were the worm and gear, just as in the previous sketches?

A. Yes.

Q. 114. And the high speed of the core was obtained from the motor, just as in the previous sketch?

A. Yes.

Q. 115. I next direct your attention to "Sketch 7[a]";

and ask you to state what changes, if any, appear over the devices illustrated in "Sketch 7".

A. I added two more rolls of fabric, making four, and a wood roll bearing on the roll of fabric, which was being used to take up the liner. I took off the worm gear, and direct geared through a clutch for the two speeds, the high and the low. I changed the drive a little; belted from a motor to a jack-shaft on the floor with a clutch on it, and from that to the pulley on the clutch-shaft.

Q. 116. In other words, there were two principal changes in this sketch. The first of them related to the fabric-supply rolls, wherein you used four rolls which were adjustable, so as to bring any desired one into operative relation to the core; and the second embodied a two-speed device for the core; is that correct?

A. Yes.

Q. 117. What was the object of the two-speed device?

A. The low speed to stretch on the fabric on the circumference of the core; the other was to get a high rotation on the core to roll it down on the side.

Q. 118. There are no rolling devices shown in this sketch, however?

A. No.

Q. 119. Now, with reference to the plan-view of the two-speed device, you think the proportions therein are correct?

A. No.

Q. 120 In other words, the detailed view of the speed-change mechanism is merely a rough sketch, without any attempt to get exact proportions; is that correct?

A. Yes.

Q. 121. In this "Sketch 7[a]" the worm for getting the circumferential stretch disappears?

A. Yes.

Q. 122. And for the first time you rely on a speed-change mechanism for getting low and high speeds; the

former being used to obtain the original circumferential stretch, and the latter to give the core a high speed for forming down the skirts of the fabric: is that right?

A. Yes.

Q. 123. Now, I want to ask you if you had ever, before your experiments, seen or known of a high-speed core?

A. No, I had not.

Q. 124. I next call your attention to "Sketch 7[b]," and ask you to state what changes appear therein over the forms shown in "Sketch 7[a]."

A. There are no side-forming devices shown in "7[a];" and my further experiments as to these side-forming devices are illustrated in "Sketch 7[b]." There was a support for a moving top table or slide to advance the tongs on which the rolls were mounted to press the side walls of the fabric down on to the core.

Q. 125. When you referred to the "slide," you mean the part marked "M," do you not?

A. Yes.

Q. 126. And on this slide was mounted tongs similar to those shown in "Sketch 7"?

A. Yes.

Q. 127. Which tongs were manipulated by the hands of the operator so as to press the spinning-rolls "R" inward against the core and form the fabric to the sides of the core?

A. Yes.

Q. 128. Now, will you kindly describe the means employed for advancing the slide "M" toward the core during the operation you have mentioned?

A. A lever "W" pivoted on the stationary stand with a slot in it pivoted to the slide "M," which would allow you of moving the table on which the tongs and rolls were supported forward or backward.

Q. 129. And how did this system of advancing the slide "M" work out in practice?

A. The tendency was to lead in quickly, and at times was hard to hold.

Q. 130. Why was it hard to hold?

A. From the tendency to lead—or for the rolls to draw it in.

Q. 131. You mean that the contact of the rolls with the fabric on the core tended to pull the slide in?

A. Yes.

Q. 132. What was the reason for this tendency?

A. In starting it on, it seemed to take a screw movement in the rolls, not advancing evenly on the side of the fabric; and, after they had started that way, they would continue.

Q. 133. You mean that it was difficult for the operator to advance the slide toward the core regularly?

A. Yes.

Q. 134. Because the contact of the rolls with the side of the core tended to pull the slide in?

A. It did.

Q. 135. And, therefore, it was not easy to get a uniform advance of the rolls; is that correct?

A. Yes.

Q. 136. I next hand you "Sketch 8," and ask you to point out the difference therein over "Sketch 7^{b}."

A. Instead of operating the slide with a lever, it was operated with a screw and hand-wheel. In the hand-wheel you were able to change the position of the handle into different holes, so the operator could be able to change the speed of advancement.

Q. 137. Now, did this device, particularly referring to the screw-feed of the slide, overcome the difficulty you have testified to in connection with "Sketch 7^{b}," as to which you stated that there was a tendency, because of the engagement of the rolls with the core, to draw the slide in by itself?

A. It did.

Q. 138. Just how and why was that tendency overcome in connection with the screw-feed?

A. The screw would not allow it to do it, held it back.

Q. 139. In other words, then, the screw had two functions: it enabled the operator to advance and retract the slide at will, and, moreover, resisted the tendency of the rolls to pull the slide in; is that correct?

A. Yes.

Q. 140. I also call your attention to the fact that the tongs as shown in the detail view are provided with a spring "S." Will you kindly state the function of that spring?

A. To bring the rolls together in rolling the fabric down on the sides of the core.

Q. 141. In other words, because of the spring "S" the spinning-rolls were forced together by a yielding or spring action; is that correct?

A. Yes.

Q. 142. Now, referring to the wheel "H" and handle "X" of the wheel, will you state how and why the insertion of the handle in one or other of the holes affected the speed of the slide advance?

A. In the hole nearest to the center it slowed it up—or the hole nearest to the center it speeded it up, and the outside hole, extreme edge, it slowed it up. Now, the slow hole is the outside hole, and the fast one was the inside.

Q. 143. So that in this way you were enabled to control, more or less, the hand operation of the operator so far as relates to the speed and regularity of advance?

A. Yes.

Q. 144. Now, referring again to the lever "W" of "Sketch 7^{b}," did the screw you used in "Sketch 8" tend to regulate the advance of the slide and make it more uniform?

A. It did.

Q. 145. I next refer you to "Sketch 9," and ask you to point out the differences therein over "Sketch 8."

A. That separated the arms that held the spinning-rolls, pivoted them separately and added a flat spring to hold the spinning-roll against the side of the core in spinning down.

Q. 146. In other words, instead of using the previous tongs, you used two separate arms independently pivoted on the slide, and in connection with each of the arms you used a flat spring to force the rolls inwardly against the side of the core; is that correct?

A. Yes.

Q. 147. Were there any handles or means of other kind connected to these arms, whereby the operator could control the pressure of the rolls against the side of the core?

A. There were two handles at right angles that a man could take in his hand and either hold it away from the core or press it against the core.

Q. 148. In other words, these control-handles were an auxiliary whereby the operator could either augment or diminish the spring pressure of the rolls against the side of the core; is that correct?

A. Yes.

Q. 149. In what circumstances would it be desirable for the operator to have this additional control?

A. After it got around the wide part of the core down toward the arms, and to draw them together, give a little more pressure at this point.

Q. 150. And did the character of the fabric you were operating on ever render it desirable for the operator to have this additional control?

A. There was times—the development was worked in an attic, and there was times when the fabric would be dried out a little and was very stiff and very hard to

handle; and ofttimes they would have to use pressure with his hand in helping the springs out, to make it stick.

Q. 151. I next hand you "Sketch 10," and ask you to point out the differences therein.

A. The table "N" that the spinning-rolls were mounted on had adjustment screws to raise and lower the table. I found this necessary in the experiment to find the position in which the rolls worked best. If they were below the center, there was a great tendency to very badly wrinkle; and the final adjustment as to height was a fraction above the center.

Q. 152. You mean to say it made a difference how the rolls were adjusted vertically in relation to the core?

A. It did.

Q. 153. And did you have any great difficulty in reaching the right point of application?

A. There was a lot of experiment on it.

Q. 154. In other words, you tried the rolls at different heights in relation to the core before you determined the final position?

A. I did.

Q. 155. And that final position, I understand you to state, to be just a trifle above the horizontal radius of the core?

A. Yes.

Q. 156. And for the purposes of these adjustments you supplied the table "N" with adjusting screws, so that you could raise or lower the arms and spinning-rolls with the table, to get the best operative position; is that correct?

A. I did, yes.

Q. 157. I call your attention to another feature in this "Sketch 10," namely, the spring "S," best shown in the detailed view. Will you kindly point out the difference between that arrangement and the one shown in "Sketch 9"?

A. It was changed from a flat spring to a coiled spring; forwarded the center toward the rolls, to bring the rolls together against the side of the core.

Q. 158. In other words, instead of employing two flat springs, one for each arm, you employed a single interior spring connecting the two arms; is that correct?

A. Yes.

Q. 159. I next hand you "Sketch 11," and ask you to point out the differences shown therein.

A. The arms were mounted forward on the sliding table were shorter, and had a flat spring against the side.

Q. 160. In other words, you reverted to the use of the two flat springs?

A. I did.

Q. 161. And also shortened up the arms and made them of different shape?

A. I did.

Q. 162. And, with reference to the pivotal position of the two arms in "Sketch 11," are they shown as pivoted at the same point of the slide "M," or at a different point?

A. They were forward, to better go round the core; practically out on the edge.

Q. 163. And were the pivots the same distance from each other?

A. A little wider apart.

Q. 164. Did you find this arrangement better than the one given in "Sketch 10"?

A. It was.

Q. 165. Can you state why?

A. Had a better clearance around the core.

Q. 166. I next hand you "Sketch 12," and ask you to comment on the changes therein.

A. We changed from a flat spring to a coiled compression spring for the arms.

Q. 167. In other words, you mean that you used a spiral compression spring for each of the arms, at the outside thereof, instead of the flat spring shown in the previous sketch; is that correct?

A. That is correct.

Q. 168. And in what respect, if any, was this employment of the spiral spring superior to that of the flat spring?

A. The flat springs didn't give as much go and come around the core; they were continually breaking and getting set.

Q. 169. In other words, the spiral springs had a greater extent and degree of elasticity than the flat springs?

A. Yes.

Q. 170. I next direct your attention to "Sketch 13," and ask you to state what it discloses in the development of the machine.

A. It shows the table head with the different tools mounted on it,—the rolling-down or spinning rolls; the tread-roll for smoothing out of wrinkles on the tread, and air-traps; the bead-setting device; and the trimming tools.

Q. 171. Was the table mounted so that these four tools that you have referred to could be brought into operation successively?

A. Mounted the same as a turret-head; could be revolved and set at any position the tool was needed.

Q. 172. In other words, the table was rotatable around an axis?

A. Yes.

Q. 173. So that you could bring any one of these four tools into operative position as required?

A. Yes.

Q. 174. I next direct your attention to "Sketch 14," and ask you to state what it represents.

A. It's the different screws that were experimented

with to advance the table on which the tools were mounted on.

Q. 175. I observe that there are four screws shown in "Sketch 14," numbered, respectively, "1," "2," "3," "4." Will you kindly state in sequence what they are?

A. No. 1 is a square-threaded screw 3/16 pitch; No. 2 is a square-threaded screw 1/8 pitch; No. 3 is a "V"-threaded screw 1/16 pitch; No. 4 is a "V"-threaded screw 1/8 pitch.

Q. 176. Did you experiment with these screws in the order indicated?

A. Yes.

Q. 177. In other words, you started with a square-threaded screw 3/16 pitch; next you employed a square-threaded screw 1/8 pitch; next you experimented with a "V" screw 1/16 pitch; and finally wound up with a "V" screw of 1/8 pitch; is that correct?

A. Yes.

Q. 178. Why was it necessary for you to go through those various steps and employ so many different kinds of screws in your experiments?

A. In attempting to get an even rolling of the spinning-rolls. With the heavy pitch, it advanced too fast, and wouldn't cover the surface completely and evenly.

Q. 179. In other words, the advance of the slide, and of the rolls thereon, was governed by the pitch of the screw; and you did not get the desired result until you had made four different attempts with different kinds of screws; is that correct?

A. Yes.

Q. 180. I next hand you "Sketch 15," and ask you to state what it represents.

A. Two types of hand stitcher-wheel; one with a very sharp edge, and one with a blunt edge. The change was made in those two because the sharp edge would cut into the fabric, groove it; and the second one was made to

correct this fault. The third is a machine stitcher-wheel, which has rather a sharp edge; which was changed to one with practically a light ball on the end,—a beaded edge. The fifth one is a machine stitcher-wheel rather blunt.

Q. 181. In other words, you did not find the ordinary configuration of the hand stitcher-wheels suitable to your purpose, and you therefore tried several types of stitcher-wheels before you arrived at the desired result; is that correct?

A. Yes.

Recess.

After recess; appearances as before:

The witness WILL C. STATE again took the witness-stand for further examination by Mr. Rogers; and he testified as follows:

Q. 182. Judging from "Sketch 15," you made the wheel larger and blunter?

A. I did.

Q. 183. Now, about the bearings of the hand stitcher-wheels; were they plain bearings, or what were they?

A. Plain bearings.

Q. 184. Did you find plain bearings suitable for your purpose?

A. I did not. They would get cut out, stick; and sometimes they would simply throw off.

Q. 185. Why did you not lubricate them?

A. Oil would get on to the fabric and spoil the connection.

Q. 186. Now, what did you use ultimately?

A. The ball bearings.

Q. 187. Now, about the angle at which you mounted

the roll in your machine in reference to the plane of the core; what was the nature of that angle?

A. Against the core it was an acute angle; and, as you got to the bead to go over—that is, it was acute enough angle to give pressure to the side of the core, and obtuse enough to go over the bead.

Q. 188. Why did you have the angle acute at all?

A. First it was necessary to compress the fabric—or, rather, press the fabric against the side of the core on the inside, and allow it to have a certain frictional contact with the skirt of the fabric on the outside to get radial stretch.

Q. 189. Was there any other reason for making the angle acute?

A. In the high speed the core rotated, and in throwing the skirt of the fabric out, you would have to make it acute enough to miss the outside edge.

Q. 190. In other words, to keep it from tangling up——

A. With the outside of the skirt.

Q. 191. With the thrown-out skirt?

A. Yes.

Q. 192. Now, generally with regard to the results of your handspinning experiments, what was the principal fault in them?

A. In the handspinning, when they had the high-speed core, got in a great deal of trouble with the skirt entangling itself with your hand, with the handspinning roll; and was not able to advance it in a regular way; was spasmodic, and didn't do a good job.

Q. 193. Did you get radial stretch enough for the hand-held tool?

A. Very little.

Q. 194. And, comparing the handspinning experiments you have testified to, namely, first, with the hand-operated core, and, second, with the high-speed, power-

operated core, were the results improved with the power-operated core, or what?

A. The troubles were intensified with the high-speed core over the hand-operated core.

Q. 195. Why, if you can tell?

A. For the reason that he couldn't run down evenly; jump; entangle with the skirt and wrinkle it; and was not satisfactory; you couldn't get the amount of stretch that was necessary in the side wall of the tire,—amount of radial stretch.

Q. 196. What was the function of the tread-roll in your machine?

A. It was simply to smooth out the extreme tread of the tire, and take out the wrinkles, air-traps.

Q. 197. In the operation of the machine, with what percentage of stretch did you put the ply on the core?

A. About 12 per cent. on the tread of the core.

Q. 198. Can you state, or have you any idea, what amount of radial stretch you got in the operation of your spinning-rolls?

A. You would get about 15 per cent. at the bead.

Q. 199. You say 15 per cent. at the bead. Do you mean by that that the maximum amount of stretch was at the bead?

A. Was at the bead, yes.

Q. 200. And that the stretch would be less than that, calculating back to the line of attachment?

A. There was very little at what would be about the middle, or median line, of the core.

Q. 201. And it increased from that up to 15 per cent. in the bead portion?

A. It would.

Q. 202. In your machine did the spinning-rolls always press the fabric against the sides of the core?

A. It did.

Q. 203. Did you ever know or hear of a mode of

operation in connection with your machine wherein the rolls were held outwardly, away from the core, so as not to press the fabric against the core, by reason of the centrifugal effect of the outflung skirts?

A. I never did.

Q. 204. Did the first commercial machine operate successfully?

A. It did.

Q. 205. Was it afterwards improved or modified?

A. Yes.

Q. 206. In what way particularly?

A. Well, one thing, the high speed was reduced.

Q. 207. Do you know what the high speed of your original machine was?

A. No, I don't remember what it was.

Q. 208. You say you subsequently diminished the amount of the high speed. What was the objection to the very high speed?

A. Extreme speed, you would have to get ahold of the core and pull it over to start it up, and it took a long time to get it up to speed; and the same story was true of trying to slow it down. If you put the brake on, it threw the core off the chuck.

Q. 209. You mean that, with the very high speed, it was necessary to impart additional momentum to the core, in order to get the speed called for in the machine?

A. Yes.

Q. 210. Now, you have referred to a brake for slowing down the speed at the end of the operation. Where was that brake applied?

A. Just inside of the bearing on the chuck side, on the shaft that the chuck is on. Here would be the tire, there the bearing, and then that (indicating).

Q. 211. Did that difficulty in securing and cutting down the original speed cause undue or unnecessary strain on the gearing?

A. Yes, was a heavy strain on the gearing.

Q. 212. How did it happen that you first gave the machine so high a speed?

A. Probably—this attic we worked to experiment in was very hot all the time, and the fabric would dry out and get very stiff; and, naturally, we weren't wasting any material in using this material; and in experimenting on the tires it would be so stiff it made us go to high speeds to secure the necessary flare-out of the skirt of the tire.

Q. 213. Was it necessary to use this high speed in connection with softer and more pliable fabrics?

A. It was not.

Q. 214. Was that the reason you subsequently cut down the speed?

A. It was.

Q. 215. You said that you were working in an attic. What do you mean by that?

A. Well, it's a two-story building with gable roof. We called it the attic of this building. It was very low; and we worked there all in the summer time.

Q. 216. You were working in the summer? The summer of what year?

A. 1907.

Q. 217. Now, relating to the springs that pressed the stitcher-arms inward, was it possible to make a tire by the use of these springs without hand control?

A. Yes.

Q. 218. Did you ever see this done?

A. I did.

Q. 219. Then what was the value of the additional hand control which you applied to these arms?

A. Along the tongue of the core, where it was thin, they could help out the pressing on by spreading them with your hand.

Q. 220. In other words, the hand control was an

auxiliary refinement, although not a necessary one in all cases; is that correct?

A. Yes.

Q. 221. Do you know when it was, about, that you finished the experimental work you have been describing to-day?

A. The latter part of 1907.

Q. 222. And, after you finished the experimental work, what was the next step?

A. Machine was put on the floor, and production.

Q. 223. I mean, after the experimental work and before the first commercial machine was constructed, what did you do after you finished the experimental work? In other words, who designed and worked up the machine for you?

A. The draftsman in my office.

Q. 224. Did you supervise the drawings of the development of that work?

A. In a general way.

Q. 225. You say, "In a general way." What do you mean by that?

A. Well, I didn't have—I didn't get right down to the details in all the apparatus; simply had a general scheme of it.

Q. 226. Did you pay close attention to all of the details of that design?

A. I did not.

Q. 227. Did you pay sufficient attention to determine whether or not your ideas were being carried into the machine?

A. Yes.

Q. 228. But you did not pay close attention to all the details of construction?

A. I did not.

Q. 229. Now, are you able to say whether or not that

first commercial machine was built entirely from drawings?

A. There was some parts of it from drawings, some from just pencil sketches, some of it was built from templates.

Q. 230. In other words, you don't think there was ever in existence a complete set of drawings for that first commercial machine?

A. There was not, that I know of.

Q. 231. Do you know whether or not at any time the Goodyear Company destroyed any of its drawings or records?

A. Along in 1913 there was a general housecleaning of the Drafting Rooms. The drawings were renumbered, especially the building drawings. A great many drawings and sketches were destroyed.

Q. 232. Do you know whether or not any of the drawings of that first machine are still in existence?

A. A few.

Q. 233. Now, these sketches that were produced by you this morning to illustrate the progress of your experimental work—whose idea was that?

A. Mine.

Q. 234. Can you tell how it was that you volunteered to make those sketches?

A. In a discussion with Mr. Rogers on the machine —the first experiments on the machine.

Q. 235. At which time did Mr. Rogers ask you what you had done in this experimental work?

A. Yes.

Q. 236. And what was your response generally?

A. Said I could sketch it out better than I could tell you.

Q. 237. Do you claim to be conversant with all of the features of advantage in the mode of operation of this first commercial machine?

A. No.

Q. 238. Referring to the machine in evidence, Plaintiff's Exhibit No. 2, when did you last see that machine?

A. In Cincinnati; during the suit at Cincinnati, three or four years ago.

Q. 239. Would you be able to testify from recollection alone as to the construction of that Plaintiff's Exhibit No. 2?

A. No.

Q. 240. Now, as to these few drawings which, you say, are still in existence, when was the last time you saw those drawings?

A. Yesterday.

Q. 241. Who showed them to you?

A. Mr. Rogers.

Q. 242. And when was the last previous time before Mr. Rogers showed them to you yesterday that you had seen them?

A. Possibly eight years.

Q. 243. And have you studied those drawings so as to be familiar with them, or know exactly what they show?

A. I have not.

Mr. Rogers: Plaintiff's counsel introduces in evidence the sketches referred to by the witness on his direct-examination, entitled "Plaintiff's Exhibit No. 8, Sketches of Experimental Work."

Direct-examination closed.

Cross-examination by Mr. Seward:

x-Q. 244. In describing the method of making tires by hand at the Goodyear factory, you used the words "take the stitcher a little sideways to work it down over the bead;" or that's the way I took my note. What did you mean by those words?

A. In coming to the bead, holding it at right angles, see (indicating)? And vertical. Do you get me?

x-Q. 245. Yes.

A. Coming around the bead, the tendency was to flip the piece over. We would turn it just a little sideways, then go on and roll it.

x-Q. 246. By "it" in your last answer you mean the stitcher.

A. The stitcher.

x-Q. 247. The Seiberling and Stevens machine laid the plies of fabric on the core substantially uniformly, did it not? I refer to the circumferential stretch.

A. Fairly uniform.

x-Q. 248. It was sufficiently uniform to accomplish the purpose designed to be accomplished by the stretch, was it not?

A. Well, here. You mean was the stretch enough to lay it uniform, or what? Do you mean——

x-Q. 249. I mean the uniformity was sufficient to satisfy the requirements of uniformity in the production of the tire?

A. No.

x-Q. 250. Were you thoroughly familiar with the operation of that Seiberling and Stevens machine?

A. Yes.

x-Q. 251. Do you think you were as familiar with it as Mr. Seiberling was,—Mr. F. A. Seiberling?

A. No, I don't.

x-Q. 252. Would you say that the laying of the fabric on to the core by that machine, as far down as the equator of the tire, was substantially perfect?

A. No.

x-Q. 253. You remember the suit of Seiberling versus Firestone, don't you?

A. No; I remember some of it, not all of it.

x-Q. 254. You were present in Cleveland during the trial?

A. Part of the trial.

x-Q. 255. Were you there when Mr. Seiberling was testifying?

A. No, I think not.

x-Q. 256. How do you know that the stretch in the plies (I refer to the circumferential stretch) was not sufficiently uniform to accomplish the purpose which the stretch was intended to accomplish in that machine?

A. I saw plies measured, giving the amount that we allowed. Sometimes it was under, and sometimes it went over; wasn't uniform.

x-Q. 257. What was the intended amount of stretch?

A. About 12 per cent.

x-Q. 258. How much did it vary?

A. O, I couldn't tell you in per cent. It would sometimes stay open. The ply would be open. And sometimes it would lap over. I say "open"—stay open sometimes a couple of inches; next time it would lap over.

x-Q. 259. By "open" you mean the ends of the piece wouldn't meet sometimes?

A. No. I mean this: the ply wouldn't lengthen the amount that was allowed for it to go on. They have a red chalk they measure that ply; and it would go over or under at times, it wasn't uniform.

x-Q. 260. Is this statement with regard to that machine true: "The machine laid the fabric upon the core; it was pressed into position by the drive roller, with its flared sides, and that work, which carried it down practically to the equator of the tire, was substantially perfect"?

A. I can't say as to that.

x-Q. 261. You don't know whether that is an accurate statement of the operation of the machine, or not?

A. No, I don't know; I couldn't say.

x-Q. 262. How do you know that the high speed of rotation of the core in that machine was about 30 r.p.m.?

A. Simply my judgment of that looking at it go, that's all.

x-Q. 263. Who had charge of the operation of that machine?

A. A man named Stevens.

x-Q. 264. Was that machine scrapped because of the financial condition of the Goodyear Company?

A. No.

x-Q. 265. It was not?

A. No.

x-Q. 266. Why was it scrapped?

A. Unsuccessful.

x-Q. 267. Can you state definitely what time in 1907 you started the experiments which you have explained this morning with reference to the sketches produced?

A. I think it was early in June.

x-Q. 268. Were those experiments all conducted in this attic to which you have referred?

A. They were.

x-Q. 269. What part of the building was that?

A. It was the front—what would be the front end toward our old office.

x-Q. 270. Was it near the Tire-making Room?

A. No.

x-Q. 271. Was it the same room in which the experiments with the Seiberling and Stevens machine had been conducted?

A. It was.

x-Q. 272. What is the name of the Mr. McDonald to whom you referred?

A. What was his given name?

x-Q. 273. Yes?

A. I couldn't tell you what his given name.

x-Q. 274. Do you know his initials?

A. Just by "McDonald."

x-Q. 275. Do you know his initials?

A. No, I do not.

x-Q. 276. Do you know where he is now?

A. He is in California, with the Goodyear plant there, the new plant.

x-Q. 277. What part of California?

A. Los Angeles.

x-Q. 278. What position did he hold in the Goodyear Company in the year 1907?

A. I think he was an inspector.

x-Q. 279. Inspector of tires?

A. Of tires.

x-Q. 280. In this first sketch, that's marked "1st device," is the shaft on which the core chuck is mounted a solid shaft?

A. Yes.

x-Q. 281. And it is rotatably mounted in a bearing in the top of the stand?

A. Yes, sir.

x-Q. 282. The worm gear is keyed to the shaft?

A. Yes, sir.

x-Q. 283. And the worm is mounted in a hinged bracket, so as to swing into and out of mesh with the worm gear?

A. With the worm gear, yes, sir.

x-Q. 284. Was that stand one of your regular stands?

A. No.

x-Q. 285. Was it made specially?

A. It was made specially.

x-Q. 286. Did you have a drawing from which that was made?

A. No; a sketch.

x-Q. 287. Who made the sketch?

A. I did.

x-Q. 288. You made the sketch?

A. Yes.

x-Q. 289. And to whom did you give it to have the stand made?

A. I don't know, by gosh! It was somebody making the patterns; I don't know who it was.

x-Q. 290. Did you hand your sketch directly to the pattern-maker?

A. I don't remember.

x-Q. 291. Do you remember what machinist worked on that device?

A. Austin Thomas.

x-Q. 292. Did any one help him?

A. No. He was by himself for awhile.

x-Q. 293. You think he made the whole of this "1st device"?

A. He made the stand. That here, and the worm. Was taken off just as it was, just as it stands there; was taken off a tire of my machine; the thing that you put in—wire tires on to a buggy.

x-Q. 294. Was the hinged arrangement part of that tire?

A. No, it was not.

x-Q. 295. Who made the sketch for that?

A. I did.

x-Q. 296. Who made that hinged bracket?

A. It was made in the shop. I don't know who made the bracket.

x-Q. 297. Well, did Mr. Thomas simply make the stand, as far as you know?

A. He did work on it, but he did it back and forth in the Machine Shop. Somebody may have helped him; I don't know.

x-Q. 298. He was the only man you can remember?

A. He was the only man I can. In regard to the "1st device".

x-Q. 299. That you can remember, except yourself?

A. Yes.

x-Q. 300. Is he with the Goodyear now?

A. No. He is dead.

x-Q. 301. How long has he been dead?

A. A matter of six or seven years; I couldn't tell you.

x-Q. 302. What was his position in 1907?

A. He was just a machinist.

x-Q. 303. Now, for the "2d device" did you use the same stand as for the "1st device"? I refer to the part which carries the worm and gear.

A. The pedestal that carries the worm and gear was used in the rear for the tension.

x-Q. 304. And you made a new stand or pedestal for carrying the worm and gear for the "2d device"?

A. No, did not. Same stand. This stand and that stand is alike.

x-Q. 305. Yes; but they were two——

A. We made another stand for the—this was the original stand. We made another stand from the same casting of the same pattern, to carry the tension.

x-Q. 306. Then, if I understand you, in the "2d device" the stand or pedestal used for carrying the worm and gear was the same identical stand as in the "1st device"?

A. Yes.

x-Q. 307. And you made a duplicate stand for supporting the fabric roll in the "2d device"?

A. Yes.

x-Q. 308. Do you know who made that duplicate stand?

A. I think Thomas did.

x-Q. 309. Who made the sketch for the brake-band in this "2d device"?

A. I did. Made it from a cut. A Raymond brake.

x-Q. 310. Was that brake purchased——

A. Couldn't be purchased. We made that. It couldn't be purchased.

x-Q. 311. Do you know who made it?

A. I think Thomas made it.

x-Q. 312. In this sketch of the "2d device" where you refer to the stock-roll sleeve, do you mean the tube on which the fabric is wound?

A. Yes.

x-Q. 313. In using the "1st device", I understand you to say that the tension was given to the fabric by a man holding the fabric in his hand?

A. A roll that had a bar through it, see? Keyed on—to this stock shell. The man had a stock-shell in his hand like this, and the fabric was rolled around it, and it was keyed to the shaft; and just by gripping; he held back.

x-Q. 314. Then the fabric roll was attached to a shaft, the ends of which shaft were held in the hands of the workman?

A. Yes, working pulling back.

x-Q. 315. And he gave the tension by his grip resisting the turning of the shaft?

A. Yes.

x-Q. 316. Was that tension more uniform than the tension given in the previous hand-making of tires at the Goodyear plant?

A. No; it wasn't as good.

x-Q. 317. How many tires did you make on the "1st device"?

A. Couldn't answer; for I don't know how many were made. Only a few, though.

x-Q. 318. Would it be less than a dozen?

A. Yes.

x-Q. 319. Were those tires completed?

A. No.

x-Q. 320. Were any of them completed?

A. Any of the first tires made on this?

x-Q. 321. Any of the tires made on the "1st device"?

A. The "1st device"? I think one or two were completed.

x-Q. 322. Were they cured?

A. Sure!

x-Q. 323. What did you do with them after they were cured?

A. I don't know what was done with them.

x-Q. 324. Were they commercial tires?

A. No.

x-Q. 325. How many tires were made on the "2d device"?

A. I couldn't answer.

x-Q. 326. Were there more than a dozen made?

A. I don't know; I am not able to answer that.

x-Q. 327. Why can't you answer it?

A. Because I don't remember.

x-Q. 328. Did you see any made on it?

A. Yes.

x-Q. 329. Can you say about how many you saw made on it?

A. No, I couldn't say how many I saw made on it.

x-Q. 330. Did you ever see one made on the "2d device" and completed?

A. I saw the carcass completed. Had no side wall or tread on it.

x-Q. 331. Do you know whether any carcass was completed into a finished tire?

A. No.

x-Q. 332. You don't know?

A. I do not know. Simply made—made the carcass. Sometimes they would be torn right down again, using the fabric over to make another.

x-Q. 333. Do you remember whether those tires made on the "2d device" were commercial tires in so far as they were constructed?

A. The carcass was made—some of the carcasses that were made on that machine——

x-Q. 334. That's the "2d device"?

A. The "2d device," were taken to the shop and the defects taken out of them, and were used.

x-Q. 335. What were the defects that were taken out?

A. Badly wrinkled; wrinkled on the side, and wrinkled over the bead.

x-Q. 336. Who made the tires that were made on the "1st device"?

A. The first experiment I did myself.

x-Q. 337. Making the tires?

A. About the tire, yes, sir, myself.

x-Q. 338. Who made most of the tires on the "1st device"?

A. The first trial on the first machine, first tire, I made myself. After that, McDonald come there.

x-Q. 339. This Mr. McDonald you referred to before?

A. Yes.

x-Q. 340. Did he also make the tires on the "2d device"?

A. He did.

x-Q. 341. Anybody help him?

A. No.

x-Q. 342. Well, can you say whether or not the tires made on the "2nd device" were commercial?

A. You mean by "commercial"——

x-Q. 343. Were they salable tires?

A. No.

x-Q. 344. I don't mean were they actually sold: were they salable?

A. I don't know whether they were sold, or not. Some of them were probably sold after they were patched up.

x-Q. 345. Did it require a good deal of work to patch them up?

A. Good deal of work, great deal of work.

x-Q. 346. Hand work?

A. Hand work.

x-Q. 347. Who made the sketch for the bracket-support "R" in the "3d device"?

A. Wasn't any sketch made. I had asked Thomas to make something to go round there to rest a man's hand. I think that he just took a piece of iron and forged it out.

x-Q. 348. Who made the sketch for the spring stitcher——

A. That was——

x-Q. 349. "AA" in the "3d device"?

A. That was handled in about the same way: taking a stitcher and asked him to put a spring in there to relieve—or, rather, so there would be some give and go to it.

x-Q. 350. Did you tell Thomas where to fasten the bracket "R"?

A. Yes.

x-Q. 351. In rotating the core by hand for the high speed in the "3d device," was it turned to the right, that is, clockwise?

A. No; it was turned to the left, toward you.

x-Q. 352. So that the part of the core or tire adjacent the bracket "R" was moving downwardly?

A. Downwardly, yes.

x-Q. 353. I understand the brake mechanism in the "3d device" is the same as in the "2d device"?

A. Yes, just the same. The brake for the tension is the same.

x-Q. 354. What kind of a roller was in this part "AA" in the "3d device"?

A. Standard stitcher-roller.

x-Q. 355. Did it have a fairly sharp edge?

A. Was a sharp edge.

x-Q. 356. Did it score the fabric?

A. It did.

x-Q. 357. Badly?

A. In places very badly.

x-Q. 358. Was that true in the operation of the "2d device"?

A. Yes.

x-Q. 359. Did the stitcher in the operation of the "3d device" score the fabric as badly as in the operation of the "2d device"?

A. It did.

x-Q. 360. Who made the tires on the "3d device"?

A. McDonald.

x-Q. 361. Any one help him?

A. There was a helper, simply a roustabout, helped on any work was necessary.

x-Q. 362. Do you remember his name?

A. Don't remember who he was.

x-Q. 363. Could you say about how many tires were made on the "3d device"?

A. No, I couldn't.

x-Q. 364. Do you know whether any of them were commercial tires?

A. They were—as I say, a few of them would be taken out that we didn't tear down, were taken out and practically torn down and rebuilt by hand.

x-Q. 365. So that this "3d device" was not really a device for producing commercial tires?

A. No, it was not—an experiment.

x-Q. 366. As to the "4th device," did McDonald make the tires that were made on it?

A. Yes.

x-Q. 367. Did he have any helper, that you remember?

A. Nothing but this roustabout.

x-Q. 368. Did anybody other than Thomas, so far as you remember, make any parts for the "4th device"?

A. I couldn't answer that.

x-Q. 369. You don't remember any?

A. I don't remember whether there was any one helped him make any of the stuff. Probably was.

x-Q. 370. When the crank was turned by hand for the purpose of stretching the fabric on in the operation of the "4th device," what happened to the belt drive for the high speed?

A. The belt drive was thrown off. Take and throw it off before you would use the stretch.

x-Q. 371. And put the belt back on again for the high-speed drive?

A. When you wanted the high speed.

x-Q. 372. What can you say about the character of the tires made on the "4th device"?

A. Handled about the same way as the other devices.

x-Q. 373. Were the tires of about the same quality as those made on the "3d device"?

A. About the same quality. Tore most of them down, patched up the rest.

x-Q. 374. Who made the suggestion for the belt drive?

A. Thomas made it.

x-Q. 375. Do I understand that, in regard to the "5th device", you applied an electric-motor drive for the purpose of enabling you to get variations in the high speed?

A. Yes, sir.

x-Q. 376. Was there any other reason for that?

A. No.

x-Q. 377. Would it not have been simpler and cheaper to have used a stepped pulley, or two stepped pulleys, in the belt drive shown in the "4th device"?

A. I don't think you could have got the variation.

x-Q. 378. You understand by a "stepped pulley" I mean a pulley having several different diameters?

A. Ordinary stepped pulley with two or three diameters.

x-Q. 379. Do you mean that the difference in the speeds between the different diameters would be too great?

A. I don't know.

x-Q. 380. That's your idea?

A. That's my idea.

x-Q. 381. What variation in speed were you able to get by the electric motor in the "5th device"?

A. There was considerable. I don't know the exact r.p.m. of the lowest speed or the highest.

x-Q. 382. Can you approximate it?

A. I would say it was along 80 or 85 was the highest.

x-Q. 383. And the lowest was about what?

A. Well, didn't use it any more than—the lowest would be probably between 70 and 85.

x-Q. 384. That variation you obtained by the rheostat you have mentioned?

A. Yes, starting rheostat.

x-Q. 385. What can you say as to the quality of the tires produced on the "5th device"?

A. Very poor yet.

x-Q. 386. Did McDonald make them?

A. He did.

x-Q. 387. Who made the suggestion for the electric-motor drive?

A. I did.

x-Q. 388. Who made the suggestion for this double stock-roll arrangement in the "6th device"?

A. I did.

x-Q. 389. Who made the sketch for it?

A. I couldn't say. I don't know who made the sketch for it.

x-Q. 390. You are sure that you made that suggestion?

A. Absolutely!

x-Q. 391. And do you remember suggesting it to some person?

A. It came about by our continually having to take

a roll off the single machine, and put another roll on, to cross the ply.

x-Q. 392. That was the reason?

A. That was the reason.

x-Q. 393. Do you remember to whom you made the suggestion of the double arrangement?

A. No, I do not.

x-Q. 394. Do you know who made the device itself, this double bracket?

A. I think that Thomas did the machine work.

x-Q. 395. That's the same Thomas——

A. Same Thomas.

x-Q. 396. To whom you have referred? But you don't recall whether you made the suggestion directly to him, or not?

A. No, I do not.

x-Q. 397. Did you suggest the treadle "G"?

A. It came about in the experiment with it, some way to hold that from flopping over when the stretching process was on.

x-Q. 398. Did you suggest that device, and for that purpose?

A. I wouldn't say whether I did, or not.

x-Q. 399. Did you suggest the connection "CD"?

A. Yes.

x-Q. 400. That specific suggestion came from you?

A. Yes, sir.

x-Q. 401. What held this part "B" up?

A. Had a spring on it.

x-Q. 402. Where did the spring work?

A. Underneath the—on the rod that goes up. Had a dog on the stand, and the spring would—this rod went through a hole, and then between this forged heavy square piece, and there was a spring put on (indicating).

x-Q. 403. So that the treadle "G" would be held up by the spring, and be depressed by the foot?

A. Yes, when you wanted to turn it over.

x-Q. 404. What happened to the belt drive in both the "5th" and "6th" "devices" when the hand-crank was used?

A. Took the belt off.

x-Q. 405. How about the tires made on the "6th device;" were they any better than those made on the "5th"?

A. No, no better.

x-Q. 406. Was the high speed in the "6th device" the same as in the "5th"?

A. About the same.

x-Q. 407. In "Sketch 7" who made the tongs "S"?

A. Charley Wattleworth made the sketch,—draftsman; a man named McBride, a foreman of the Blacksmith Shop, forged them out.

x-Q. 408. Mr. Wattleworth is where now?

A. He is in Akron.

x-Q. Is he working for the Goodyear Company.

A. He is not.

x-Q. 410. Where is he working?

A. I think he is with the Falls Tire Company.

x-Q. 411. He was a draftsman with the Goodyear Company in 1907?

A. Yes.

x-Q. 412. What was Mr. McBride's first name?

A. Martin.

x-Q. 413. Is he with the Goodyear Company now?

A. He is.

x-Q. 414. What is his position?

A. Foreman of the Blacksmith Shop.

x-Q. 415. This part "R" in "Sketch 7" is vertically adjustable in the stand, is it not?

A. Yes.

x-Q. 416. That's what you meant by referring to it as adjustable in your direct testimony?

A. Not in this instance.

x-Q. 417. What did you mean?

A. I didn't refer to it in this—as I remember, in this instance.

x-Q. 418. I think you mentioned this bar on which the tongs were designed to rest as an adjustable one.

A. Yes, could be worked up and down; yes, that's true.

x-Q. 419. That's the only adjustment it had?

A. That's the only adjustment.

x-Q. 420. Its vertical adjustment in its stand?

A. Yes, sir.

x-Q. 421. What was the purpose of that adjustment?

A. To get the tongs in different positions.

x-Q. 422. With respect to the height of the core?

A. Just the height of the core.

x-Q. 423. Did you find, in using the device of "Sketch 7", the proper position of the spinning-rollers or stitchers with respect to the core? I mean the proper position as to height?

A. No; did not.

x-Q. 424. At what position with respect to the core in a vertical direction did you use the spinning-rolls of "Sketch 7"?

A. I don't remember what height that was.

x-Q. 425. Who operated this device of "Sketch 7"?

A. McDonald.

x-Q. 426. Do you remember any one else that helped him?

A. No.

x-Q. 427. Who made the adjustable part "R"?

A. As referred to; McBride made it.

x-Q. 428. Who suggested that that adjustable part "R," and its stand, be made?

A. Why, I think McDonald did.

x-Q. 429. The fabric-support and the brake in the device of "Sketch 7" are the same as the "6th device"?

A. Yes.

x-Q. 430. I note that, in the little plan-view of "Sketch 7," the part "R" seems to be at an acute angle to the plane of the core. Is there any reason for that?

A. To keep the tongs from tilting.

x-Q. 431. Who suggested turning it to that angle?

A. I don't know.

x-Q. 432. Was the high speed of "Sketch 7" about the same as the "6th device"?

A. About this time we began to change the pulley diameter on the motor, getting a little higher speed.

x-Q. 433. What high speed did you get in "Sketch 7"?

A. Along 90, 95.

x-Q. 434. When was this? Do you remember what month of 1907?

A. No, I couldn't tell you.

x-Q. 435. As to "Sketch 7*a*," who suggested the arrangement for holding four rolls of fabric?

A. The four rolls of fabric came about in—came back from the Tire Room. There was so much waste on the tires they were making there, after they would start them on here,—there was so much waste the suggestion was started over there that we cut down on the fabric. Therefore, the first two plies to go on the core should be narrow, and the other plies would be wide. And that check was made by somebody in the department, who asked that some way we cut down those first two plies; and that added the other two rolls of fabric to the head.

x-Q. 436. Do you remember who it was suggested the adding the other two rolls to the head?

A. The suggestion to some way to cut down the amount of fabric we were using; but who that suggestion

came from I don't know; but, when the suggestion came in, we had a sketch made of it, of one with four on.

x-Q. 437. Who made that sketch?

A. I think Charley Wattleworth.

x-Q. 438. Now, this "Sketch 7*a*" has a take-up roll "G" for the muslin liner.

A. To take the muslin liner off.

x-Q. 439. How could that work in connection with the three rolls that are shown as spaced from it?

A. That roll would come off.

x-Q. 440. The roll "G," you mean?

A. This little wood roll that took up the liner, you would pull it off, lay that aside. Then, when it came over again, you put another wood roller in it and turn the liner over.

x-Q. 441. You would put a little roller "G" on its axle each time you brought one of the fabric rolls into position?

A. Yes, sir.

x-Q. 442. Well, did you cut the liner when you took the roll "G" off after it had been used?

A. The liners were in short lengths; and sometimes we had to roll back to get it; and then the boy, somebody, that helper there, would take it and wind it up again on the other roll.

x-Q. 443. I meant to ask you about the quality of the tires made on the device of "Sketch 7." Were they any better than the tires of the "6th device"?

A. Very poor. Still was very poor.

x-Q. 444. You spoke about the plan-view of the gearing in "Sketch 7ª" as being out of proportion. Do you remember what the proportions of those gears, "R," "S," "M," and "N," were?

A. No, I do not.

x-Q. 445. You don't remember, then, the ratio of the high and low speed in that device?

A. The low speed was something along 10 or 12, and the high speed was along 85 or 90.

x-Q. 446. Was the power obtained from an electric motor?

A. Yes.

x-Q. 447. What is meant by this little diagrammatic figure near the top of "Sketch 7ª"? Does that mean the drive to the jack-shaft?

A. On the floor there was a jack-shaft had a clutch on it and a pulley, straight pulley. From the motor it went to here, and then from this clutch it went up to this pulley on the drive for the machine.

x-Q. 448. Then on this little diagrammatic sketch the lefthand circle is the electric-motor pulley?

A. Yes.

x-Q. 449. The two center circles are the jack-shaft and pulley?

A. Jack-shaft, pulley, and clutch.

x-Q. 450. And the righthand circle——

A. Is the pulley on the drive——

x-Q. 451. For chuck?

A. Yes, sir.

x-Q. 452. What size of tires did you make on these first eight devices?

A. 3½ clinchers.

x-Q. 453. All the same size?

A. Yes, sir.

x-Q. 454. What was the diameter? Do you remember?

A. Think it was 30 inch. Some were 28.

x-Q. 455. In connection with the device of "Sketch 7ª" did you have the spinning-rolls arranged as shown in the "Sketch 7"?

A. No; I hadn't them on at all. Was just working out speeds, stretching on.

x-Q. 456. Then you did not make any tires on the device of "Sketch 7ª"?

A. I did eventually. I afterwards put a device on to.

x-Q. 457. You are referring now to "Sketch 7[b]"?

A. "7[b]."

x-Q. 458. But you tried the device of "Sketch 7[a]"——

A. Simply for stretching.

x-Q. 459. Simply for stretching? Do you remember when that device of "Sketch 7[a]" was made?

A. No, I don't.

x-Q. 460. In the apparatus of "Sketch 7[b]" the fabric rolls and their supports, and the take-up roll, is the same as "Sketch 7[a]"?

A. Yes. It is the same.

x-Q. 461. The drive for the core is the same?

A. It is the same, with one exception,—that we had speeded it up a little, speeded the high speed up a little.

x-Q. 462. What speed did you get for the high speed in "Sketch 7[a]"?

A. Something along about a hundred.

x-Q. 463. And what was the low speed?

A. About 9 or 10.

x-Q. 464. Who made the suggestion for this slide marked "M" in "Sketch 7[b]"?

A. I did.

x-Q. 465. Who made the sketch for it?

A. Charley Wattleworth.

x-Q. 466. What did you say to him about that?

A. I don't know the detail of what I said to him. I probably made some pencil sketches and discussed it with him to make a slide for it.

x-Q. 467. Did you tell him to make an undercut slide?

A. What do you mean—"an undercut slide"?

x-Q. 468. What kind of a slide do you call that of "Sketch 7[b]"? I want to use your terminology, so you will understand it.

A. Why, it's what you call a "V" slide.

x-Q. 469. Did you tell Wattleworth to make a "V" slide?

A. No, I didn't.

x-Q. 470. Can't you tell me in general what you told him about that?

A. Simply told him to make a sketch of a holder, a pedestal holder; and wanted an adjustable slide made on it. He worked out the detail.

x-Q. 471. Then the part on which you made this sketch was the pedestal on which the slide "M" is mounted?

A. Yes.

x-Q. 472. And you told him you wanted an adjustable holder on it?

A. Yes, adjustable slide.

x-Q. 473. Did you tell him how it should be made adjustable?

A. No.

x-Q. 474. Did you describe to him the lever arrangement for moving it?

A. No, I did not.

x-Q. 475. Did he design that himself?

A. He designed that himself.

x-Q. 476. From this "Sketch 7[b]" it would appear that the pedestal which holds the slide "M" is itself slidable.

A. It is.

x-Q. 477. On a lower part.

A. It is.

x-Q. 478. Who made that suggestion?

A. He did.

x-Q. 479. Wattleworth did?

A. Charley Wattleworth. Came about in his detail—when he started to draw it up to show for different diameters of core; it would have to move in and out.

x-Q. 480. How were the tongs which carry the spinning-rollers mounted on this slide "M" in "Sketch 7[b]"?

A. Just a cap-screw right through.

x-Q. 481. That acted as one pivot?

A. One pivot for the two.

x-Q. 482. Was there any spring on the tongs?

A. Yes. Spring on the rear to pull them together.

x-Q. 483. Like that shown——

A. Like that sketch there.

x-Q. 484. To the right, at the bottom of "Sketch 8"?

A. To the right, yes, sir,

x-Q. 485. Who made the suggestion for that spring?

A. Charley Wattleworth.

x-Q. 486. How high were the tongs mounted with respect to the core in "Sketch 7^{b}"?

A. In that machine I couldn't tell you just what they were.

x-Q. 487. Do you remember whether they were above or below the center of the core?

A. I couldn't tell you. They were somewhere around the center. I don't know whether they were above or below.

x-Q. 488. Did you make tires on the device of "Sketch 7^{b}"?

A. Yep.

x-Q. 489. Were they any better than the tires made on the device of "Sketch 7"?

A. They were just beginnig to get a little better. Yes, they were a little better than that.

x-Q. 490. In the device of "Sketch 7^{b}" did you have the support gearing and clutch arrangement shown to the left at the bottom of "Sketch 7^{a}"?

A. Yes.

x-Q. 491. Do you know whether or not any tires made on the machine of "Sketch 7^{b}" were completly finished?

A. No, I do not.

x-Q. 492. Who made the tires on that machine?

A. The same man, McDonald.

x-Q. 493. Up to this time had any machinist or tire-

maker, that you can remember, other than those you have named, worked on these machines?

A. Austin Thomas, the machinist, worked on them; and, I think, at this stage Al Shaw.

x-Q. 494. Is that Albert Shaw?

A. Albert Shaw.

x-Q. 495. Where is he now?

A. In Akron.

x-Q. 496. In the employ of what concern?

A. Goodyear Tire & Rubber.

x-Q. 497. What postion does he hold?

A. I think he is in the Experimental Department. He may be in the Patent Department. I couldn't say.

x-Q. 498. Would you say that the tires made on the machine of "Sketch 7[b]" were salable and usable tires?

A. No.

x-Q. 499. Did you tell me what the high speed was in the machine of "Sketch 7[b]"? If not, will you say about what it was?

A. I judge about 95.

x-Q. 500. In the device of "Sketch 8" you show a screw for feeding the slide "M". That is a high-speed screw, is it not?

A. Yes.

x-Q. 501. Who suggested that?

A. That came out in the detail for the drawing on that head. Wattleworth worked that detail out.

x-Q. 502. And this arrangement of holes for receiving the handle "X"—who made that suggestion?

A. That was put in—I think Wattleworth did it.

x-Q. 503. Did you find that to be a valuable or important feature?

A. Yes, I did . It gave us a variation of feeding it in.

x-Q. 504. And it really would work to that effect?

A. A man would work it that way.

x-Q. 505. So that it would make the inward feed more

accurate than if it were simply left to the man's judgment?

A. Matter of speed in changing speed.

x-Q. 506. Did it make the rate of inward feed of the slide "M" more accurate?

A. Low speed made it a little lower; that is, the inside made it a little lower—the outside made it a little lower.

x-Q. 507. In other words, if I understand you correctly, it was better than simply leaving the handle in the one place and leaving the rate of inward feed to the workman's judgment?

A. Yes.

x-Q. 508. About when was that machine of "Sketch 8" made?

A. It was about the middle of the summer.

x-Q. 509. Of 1907?

A. Yes.

x-Q. 510. Are you sure it was before 1908?

A. Yep.

x-Q. 511. Up to this time had Mr. Frank R. Chamberlain worked on any of these machines?

A. No.

x-Q. 512. How about Mr. Smith?

A. I don't remember ever Smith at that time.

x-Q. 513. Had a Mr. William Kreuder worked on it up to that time?

A. No. He was foreman. He wouldn't have any reason to be near it. He was foreman of the Mill Room.

x-Q. 514. And he had nothing to do with these devices of the sketches we have so far discussed?

A. Nothing whatever at all.

x-Q. 515. Why did you put on the leaf-springs "S" shown in "Sketch 9"?

A. Well, it was simply a form of pressure.

x-Q. 516. Well, who suggested changing from the spiral spring to the leaf-spring?

A. The spiral spring of the tongs to the leaf-spring I think I suggested myself.

x-Q. 517. And who suggested pivoting the arms which carried the spinning-rollers separately, as in "Sketch 9," instead of on one pivot, as in "Sketch 8"?

A. There was a template made for those arms.

x-Q. 518. Of "Sketch 9"?

A. Yes. In fact, several templates were made for different types of arms in the Drafting Room, cut out of pasteboard; and I believe that Wattleworth suggested those pivoted in that position.

x-Q. 519. As shown in "Sketch 9"?

A. In "Sketch 9."

x-Q. 520. Do you remember the names of any of the other draftsmen who worked on those templates?

A. No, I don't remember them.

x-Q. 521. Can you tell me how the pedestal which supported the bracket "M" in "Sketches 7[b]," "8," and "9" was secured in any desired adjustment on the part on which it would slide?

A. There was what was known as a "gib." It was wider than necessary; and a piece slid in there, and then they would screw a steel "gib" in there, then set-screws along the side there and tighten it up.

x-Q. 522. In "Sketch 10" there is a coil-spring, again, on the arms which carry the spinning-rolls. Who suggested putting that in place of the leaf-springs "S" which you suggested, as shown in "Sketch 9"?

A. I did.

x-Q. 523. Why did you make that change?

A. Had more tension.

x-Q. 524. And who suggested the provision of vertical adjustment of the table "M" shown in "Sketch 10"?

A. I did.

x-Q. 525. That was merely for the purpose of experimenting, was it not?

A. Yes, experimenting and getting the position to run the rolls in.

x-Q. 526. Were tires made on the machine of "Sketch 8"?

A. Yes, a few.

x-Q. 527. Were they better than the tires made on the machine of "Sketch 7[b]"?

A. About the same.

x-Q. 528. How about the machine of "Sketch 9,"—were tires made on it?

A. Yes.

x-Q. 529. Were they any better than the tires made on——

A. They were getting better on that machine; better tires made on that than the previous ones.

x-Q. 530. That is, the tires made on the machine of "Sketch 9" were better than those made on the machine of "Sketch 8"?

A. Yes.

x-Q. 531. How about the high speed of the machine of "Sketch 8"?

A. That was the same as the previous machine.

x-Q. 532. And how about the high speed of the machine of "Sketch 9"?

A. We had run that speed up. That speed along that time was along 110, 112, 115.

x-Q. 533. How about "Sketch 10," the high speed of that machine?

A. That was, as I say, about 110—that's about 110 or 115.

x-Q. 534. Do you know whether any tires made on the machine of "Sketch 10" were completed and put into use?

A. I think there was a few of them.

x-Q. 535. Would you say those tires made on that device were salable and usable tires?

A. They were used on tests; put out and tested; they weren't sold.

x-Q. 536. Do you know what they showed on test?

A. No, I don't remember. They showed up fairly well.

x-Q. 537. Would you say they were salable tires?

A. They would have been salable tires; but they used them on tests.

x-Q. 538. Did that apply to the tires of the machine of "Sketch 8"?

A. No.

x-Q. 539. Can you say why the tires of the machine of "Sketch 10" were salable and those of the machine of "Sketch 8" were not; in other words, can you account for the difference in quality?

A. We were able to raise and lower that table to get it in more even, to get away from the wrinkling which the —which would come about by the spinning-rolls not being in the right position.

x-Q. 540. Then, if I understand you correctly, the improvement in the product was due to the provision of this vertical adjustment of the table "M"?

A. That with the higher speed.

x-Q. 541. Of rotation of the core?

A. Of rotation of the core.

x-Q. 542. Who made the experiments with this vertical adjustable table shown at the bottom to the left in "Sketch 10," to see what should be the proper height for the spinning-rolls with respect to the core?

A. I supervised it with Thomas and McDonald.

x-Q. 543. Did you stand directly over those tests, or did you let them make them and report to you?

A. Stood directly over them and saw it done.

x-Q. 544. And how long did you experiment before you got the proper height for the spinning-rolls?

A. Well, don't know what. Was quite a bit of time devoted to it.

x-Q. 545. Several days?

A. Yes.

x-Q. 546. Is that a very important point for the successful operation of the machine?

A. It's one of the important points.

x-Q. 547. Did you discover that fact, and what the proper point was, in the year 1907?

A. Yes.

x-Q. 548. In "Sketch 11" the mounting for the spinning-rolls is somewhat different from that shown in "Sketch 10." Do I understand that you suggested this?

A. I suggested widening them out, shortening them, and putting them forward on the table.

x-Q. 549. As I understand your last answer, you mean to say you suggested spacing the pivots for the arms which carried the spinning-rolls further apart; you suggested shortening the arms themselves;——

A. Yes.

x-Q. 550. And you suggested placing the pivots nearer the front of the table "M"?

A. Yes.

x-Q. 551. Why did you use leaf-springs in the arrangement shown in "Sketch 11," instead of coil-spring as shown in "Sketch 10"?

A. Couldn't get the pressure—couldn't get quite the pressure with the springs across here (indicating); and they would interfere with the tire. If the spring was in there enough to pull that together, coil-spring enough to pull that together, it would kill the tire; and had to get on the outside.

x-Q. 552. I understand you mean you had put a coil-spring between the two arms in the machine of "Sketch 11" so as to draw them together; you would not have the

proper pressure, and the spring itself might interfere with the core or tire?

A. Not so much the proper pressure as it would interfere with the tread of the tire.

x-Q. 553. The spring itself might contact with the tread of the tire?

A. To get a strong enough spring on there to get a pressure to bring the rolls against the side of the tire, the spring would have to be so far forward that it interfered with the tread of the tire.

x-Q. 554. In other words, for the spring to have sufficient leverage in acting on the arms, it would have to be so far away from the pivots of the arms that it would have to interfere with the tire?

A. Yes.

x-Q. 555. Did you find those leaf-springs "S" of "Sketch 11" satisfactory?

A. No.

x-Q. 556. Were any tires made on this machine of "Sketch 11"?

A. They were.

x-Q. 557. Were any of them finished and tested?

A. Finished and tested.

x-Q. 558. Were they good tires?

A. Yes.

x-Q. 559. Now, when was this machine made, "Sketch 11"?

A. Well, it was just—I would say it was along in August.

x-Q. 560. 1907?

A. 1907. Possibly July. I am not sure. July or August. Some place in there.

x-Q. 561. There were no other distinctions between the machine of "Sketch 11" and the machine of "Sketch 10" except those which you have mentioned in connec-

tion with the stitcher mounting; is that right? Is that right?

A. Yes, that's correct.

x-Q. 562. Now, in "Sketch 12" the change from "Sketch 11" is in the arrangement of spring pressure for the arms carrying the stitchers; is that right?

A. That's right.

x-Q. 563. Who suggested that particular arrangement shown in "Sketch 12"?

A. I did.

x-Q. 564. Who made the sketch for it?

A. Wasn't any sketch made.

x-Q. 565. To whom did you suggest it?

A. Aust Thomas.

x-Q. 566. Do you remember about what you said to him?

A. Suggested to put a spring tension instead of the flat spring. It was breaking, getting out of order. Put a coil-spring and compression against it.

x-Q. 567. Did you suggest putting the guide-rods inside of the springs "S" in "Sketch 12"?

A. Yes. It wouldn't work, if it wasn't.

x-Q. 568. And you mentioned that to Thomas?

A. Yes.

x-Q. 569. Did you tell him to what part of the arms carrying the stitchers those springs should be pivoted?

A. Yes, about half way.

x-Q. 570. Half way between the pivot of the arm and the stitchers?

A. Stitchers.

x-Q. 571. What is the reason for this sketch at the bottom of the drawing entitled "Sketch 12" which shows another form of stitcher-arm?

A. This was made first, and this is second.

x-Q. 572. The form shown in the sketch at the bottom

was made first; and the form shown in the sketch above was made second?

A. Second.

x-Q. 573. Who suggested the form shown in the sketch at the bottom?

A. I did.

x-Q. 574. Why did you go back to the form of stitcher-arm shown in "Sketch 10," instead of adhering to the form of stitcher-arm shown in "Sketch 11"?

A. Wanted to try whether it would be easier, with a longer fulcrum on the back to open it to go in to go over the ball of the tire.

x-Q. 575. You thought that the longer arms might make it easier for the workman to separate the stitchers?

A. Yes. We had them there, and tried them out that way.

x-Q. 576. Were tires made on the machine of "Sketch 12"?

A. Yes.

x-Q. 577. Were they good tires?

A. Pretty fair tires.

x-Q. 578. Were they better than the tires made on machine of "Sketch 11"?

A. About the same.

x-Q. 579. Would you say they were salable, usable tires?

A. They were usable tires.

x-Q. 580. What defects, if any, did they have?

A. They weren't as uniform——

x-Q. 581. In what respect?

A. As—not uniform; there were a great deal of hand work in finishing.

x-Q. 582. And that applies also to the tires of "Sketch 11"?

A. Yes.

x-Q. 583. I mean by that, made on the machine of "Sketch 11"?

A. Wrinkles.

x-Q. 584. Wrinkles in the fabric, that had to be removed by hand?

A. Yes.

x-Q. 585. Required a great deal of hand work that had——

A. Not a great deal. They were getting better.

x-Q. 586. In "Sketch 13" you again show the leaf-springs. Why did you go back to those? I mean the springs "S"?

A. Simply experimenting back and forth, testing them out.

x-Q. 587. Did you find that the springs of "Sketch 12" were not entirely satisfactory?

A. They were better than the leaf-spring.

x-Q. 588. Then why go back to the leaf-spring in the machine of "Sketch 13"?

A. Simply more testing.

x-Q. 589. But you had already tested the leaf-springs shown in "Sketch 13" when you made the machine in "Sketch 11," had you not?

A. I had made it of certain materials and springs. Changed the temper, changed the material they were made out of; thought possibly they would work better.

x-Q. 590. What was the objection, if any, that you had to the coil-springs shown in "Sketch 12"?

A. There was no great objections to them; just a matter of experimenting.

x-Q. 591. You thought that a leaf-spring made of some different material might be better?

A. Might be better.

x-Q. 592. Who suggested the arrangement of the tread-roll as shown in "Sketch 13"?

A. I did.

x-Q. 593. How about the cutters?

A. I did.

x-Q. 594. And the bead-applying devices?

A. I did.

x-Q. 595. Did you make sketches of those?

A. Yes, there were sketches made. Wattleworth made the sketches. I made pencil sketches; Wattleworth made detail sketches.

x-Q. 596. You made pencil sketches of all three,—the tread-roll, bead-cutter, and bead-applying roll?

A. Yes.

x-Q. 597. And did you show how they should be arranged on the table?

A. No, I did not.

x-Q. 598. Who placed them on the table, or designed the arrangement?

A. I think Wattleworth placed them in their position.

x-Q. 599. When making tires on the devices prior to that shown in "Sketch 13," how did you roll down the tread part of the fabric?

A. There wasn't a great deal of rolling down to it. Was simply smoothing out little wrinkles, the air out of it; wasn't designed to roll it out at all.

x-Q. 600. How was that done before you had the tread-roll around the machine?

A. The amount of stretch we put on there, about 12%, would just go over, a little bit over, the round of the ball; and the tread-roll, if there were any wrinkles coming from contraction coming in would roll it out and roll out the air bubbles.

x-Q. 601. I am asking you what device did you use for rolling down the tread in the machines before you incorporated the tread-roll as shown in "Sketch 13"?

A. Oh! Did it by hand-roll, just a wide roll.

x-Q. 602. Tread-roll held in the hand of the operator?

A. Just in the hand of the operator.

x-Q. 603. In "Sketch 14" when was the screw shown in Fig. 1 designed?

A. It was the first one we used.

x-Q. 604. About when was the screw shown in Fig. 2 designed?

A. The second one.

x-Q. 605. Who suggested the screw of Fig. 2?

A. I think I did.

x-Q. 606. Did you suggest the form of the thread and the pitch?

A. Yes.

x-Q. 607. How about the screw of Fig. 3? Who suggested the form of the thread and pitch of that?

A. They wanted to cut it down a little, and I think Thomas did.

x-Q. 608. How about the screw of Fig. 4? Who suggested the form of thread and pitch of that?

A. No. 3 was just a bit slow, and we went back to an eighth-inch pitch.

x-Q. 609. Who suggested that?

A. I did.

x-Q. 610. Are you sure you suggested that?

A. Yes.

x-Q. 611. Did you make a sketch, or did you simply say?

A. No, simply said send it back to No. 8 thread.

x-Q. 612. What was the advantage of the "V" thread over the square thread?

A. Well, in experiments you could cut that with a die, and the other was cut in a lathe; you had to cut the square thread in a lathe, and there wasn't much variation in the pitch; couldn't get much variation in the pitch, and you could get it in a "V" thread; it would go up and down on the pitch very easy.

x-Q. 613. That is, you could change the pitch of the "V" thread more easily than that of the square thread?

A. Yes; and there was a limit to the pitch on a "V" thread, as to the speed of it.

x-Q. 614. You mean "V" thread there?

A. No; I mean square thread.

x-Q. 615. The teeth on the screw of Fig. 4 seem to be wider than that of Fig. 3. Is that simply because of the pitch?

A. Yes; sixteenth narrower than the eighth; twice as many threads in 3 as there is in 4.

x-Q. 616. For a given length?

A. For a given length per inch.

x-Q. 617. Was the use of a "V" thread an important advantage over the use of a square thread?

A. Not particular.

x-Q. 618. But it was some advantage?

A. Some advantage: you could get a slower thread, if you wanted to.

x-Q. 619. In "Sketch 15" do I understand the figure at the top, to the left, entitled "Hand stitcher-wheel," is intended to represent the ordinary hand stitcher-wheel in use prior to the beginning of your experiments?

A. Yes.

x-Q. 620. And the figure immediately to the right, with the same title, is intended to represent what?

A. A hand spinning tool that we made up on our hand spinning operations.

x-Q. 621. A special tool you made?

A. Simply—the special part of it was blunter edge.

x-Q. 622. Who suggested that, and when was it suggested?

A. I suggested it. It came about from the other creasing it so and cutting into the fabric in hand spinning operation.

x-Q. 623. To whom did you suggest it?

A. Aust Thomas.

x-Q. 624. What did you tell him to do?

A. Just to make up another spinning-roll with a blunter edge.

x-Q. 625. Is that all you said to him?

A. That's all.

x-Q. 626. The next figure, entitled "Machine stitcher-wheel," is intended to represent what?

A. A stitcher-wheel we were using on our first experiments on the tongs, and some of the subsequent experiments.

x-Q. 627. Was that made after the hand stitcher-wheel with the blunt edge?

A. Yes.

x-Q. 628. Why did you make the edge on this first machine stitcher-wheel narrower than the edge on the blunt hand stitcher-wheel?

A. We thought with the mechanically operated spinning-rolls that we could cover the surface with a little narrow one. We couldn't do it even with the broad one even by hand operation.

x-Q. 629. What do you mean, Mr. State, by "cover the surface"?

A. Of the tire in rolling it down.

x-Q. 630. You mean act upon all parts of the surface?

A. Act upon all parts of the surface.

x-Q. 631. And why did you make this first machine stitcher-wheel of dishlike form?

A. For the face of it to miss the fabric, the skirt of the fabric.

x-Q. 632. Which face was towards the core—the flat one or the——

A. The lower face.

x-Q. 633. That is, the flat face?

A. The flat face was towards the core.

x-Q. 634. The next machine stitcher-wheel is like the one just mentioned, only the edge is blunter; is that correct?

A. Yes.

x-Q. 635. Why did you make it blunter?

A. It is blunter and it is ribbed to get more contact in pressing it on to the core, and more friction resistance to the skirt in getting the radial stretch in rolling it down.

x-Q. 636. Did the ribs run crosswise with the edge?

A. No; round with the edge.

x-Q. 637. Circumferential with the edge?

A. Yes.

x-Q. 638. How many ribs were there on the edge?

A. One.

x-Q. 639. Was that rib a little ridgelike?

A. Just a raise.

x-Q. 640. Rounded?

A. Rounded.

x-Q. 641. And how did that work?

A. Worked very well.

x-Q. 642. Was the width of the edge of this stitcher about the same as that of the blunt hand-stitcher?

A. A little bit less, just a fraction less.

x-Q. 643. Then why did you go to the last form of machine stitcher, which is shown as flat on both sides, with a blunt edge?

A. We was trying to get more clearance between the roll and the fabric.

x-Q. 644. And you used that because the bearing was not as long, or the hub not as long?

A. No. It cut down the hub,—the thickness; and tried to make it avoid, as I say, the skirt of the tire when it was turned back, when the core was revolving at high speed.

x-Q. 645. By making the hub shorter, the stitcher would be moved bodily further away from the core?

A. No; the fabric—it would be farther away from the fabric that turned out from centrifugal force, turned out.

x-Q. 646. Was the edge of this flat machine stitcher wider than the edge of the machine stitcher shown immediately above it?

A. It was about the same.

x-Q. 647. Did the flat machine stitcher have a rib on its edge?

A. No; just round.

x-Q. 648. Why did you give up the rib?

A. Well, got the same effect. We didn't have to hollow it out. Got the same effect, less the extreme width.

x-Q. 649. You found you didn't need the rib on the edge; is that it?

A. No; I found that I didn't need this width. Yes. Could get along without the rib. Go flat through there, instead of recess.

x-Q. 650. Will you tell me again why the flat machine stitcher would work without the rib, when you desired the rib on the form of machine stitcher shown immediately above it?

A. We thought that it would—in going down the side of where the core recesses quickly to the tongue, I thought possibly it would shear more on the side if it was flat, and, if I recessed it, it would relieve it a little.

x-Q. 651. What do you mean by the "recessed"?

A. See, where the dotted line shows?

x-Q. 652. Yes.

A. That is recessed into the stitcher. The material is cut out.

x-Q. 653. Then, if I understand you now, the machine stitcher shown in the second view from the bottom of "Sketch 15" had the rib as a depression instead of a raise?

A. No, it's raised; and it would be depressed away from it.

x-Q. 654. On both sides?

A. No, on one side.

x-Q. 655. On one side? Now, I understand you to mean that, in the machine stitcher shown in the second view from the bottom, the face which appears as a flat side was really somewhat concave?

A. No, it is not. The bead naturally—this is recessed back; naturally a line shown through there is the outside point of the bead. It was cut out inside there, turned in here.

x-Q. 656. Yes, I understand, just like that?

A. Yes.

x-Q. 657. That's what I mean by "concave".

A. Yes.

x-Q. 658. In other words, the side which appears to be flat was centrally depressed so as to leave a peripheral ridge extending in an axial direction?

A. Yes.

x-Q. 659. When you increased the speed of rotation of the core, was there more tendency for the stitchers to jump at the plies of the fabric?

A. In the hand operation that was true.

x-Q. 660. Was there that tendency in the machine operation?

A. No.

x-Q. 661. Why was there not that tendency in the machine operation?

A. It was done more mechanically. Wasn't allowed to get out of line; controlled better, and wouldn't act that way.

x-Q. 662. What machine are you referring to in your last answer?

A. The last machine in the sketch.

x-Q. 663. That would be the machine of "Sketch —"——

A. This one here.

x-Q. 664. "12," I suppose, you mean?

A. Yes; "12" is right.

x-Q. 665. And also "11" and "10"?

A. No. It would be in "11." It was better in "11."

x-Q. 666. How about "10"?

A. Not so good.

x-Q. 667. Was there much tendency to jump at the plies in the machine of "Sketch 10"?

A. No.

x-Q. 668. Can you say about what was the high speed in the last machine you made and used in the attic; I mean the high speed of rotation of the core?

A. The last machine? Are you referring to machine went on the floor?

x-Q. 669. I am referring to the one you said you used for making tires up in the attic.

A. The last machine was made in the attic——

x-Q. 670. In the latter part of 1907.

A. That was put on the floor? No, I don't remember that speed.

x-Q. 671. Can you give it to me approximately?

A. No, I couldn't; I don't remember just what that speed was. It was very high; I remember that.

x-Q. 672. Was it over a hundred r.p.m.?

A. Yes, it was over a hundred.

x-Q. 673. Was it over a hundred and fifty r.p.m.?

A. I can't say.

x-Q. 674. Why is it you can't remember that commercial machine and you can remember the experimental ones?

A. Well, we were changing motors on that commercial machine; and, as I say, we just kept changing motors in the gear and running speeds up in the attic until that hard fabric could be handled. There wasn't much attention paid to what that speed was.

x-Q. 675. Did you decide or determine in 1907 what was the most desirable high speed for rotation of the core?

A. I know the action on fresh fabric was along 120, 125.

x-Q. 676. You decided that for yourself?

A. Decided that in the operation of the machine.

x-Q. 677. You decided that in 1907?

A. Well, it was the latter part of 1907.

x-Q. 678. Did you change your view in that respect in the year 1908?

A. We changed our view from extreme high speed it had gotten to when we were getting fabric fresh from the calenders.

x-Q. 679. What I meant by the last question, Mr. State, was, did you, during the year 1908, still believe that about 120 or 125 r.p.m. was the best high speed for the core when using fresh fabric?

A. I don't know whether that was the time, or not.

x-Q. 680. You say that you determined that in the latter part of 1907?

A. I don't know, I am not positive what speed it was.

x-Q. 681. Did you, at any time during the year 1908, determine or decide what, in your opinion, was the best high speed for rotation of the core in the machine when using fresh fabric?

A. I don't know what that was now.

x-Q. 682. I am asking if you did determine any?

A. I didn't—no, I did not.

x-Q. 683. Did you have any idea what was the best?

A. No, I did not.

x-Q. 684. Have you ever determined what is the best high speed for rotation of the core?

A. I know that there were a great deal of experiment done on the speeds. For instance, one day they could have fresh fabric; then a rule was that the fabric ought to age at least three days; then you would get it stiff; and there was a great deal of experimenting back and forth.

x-Q. 685. When was that?

A. That was when the machine was put in to work commercially.

x-Q. 686. 1908?

A. 1908.

x-Q. 687. Well, did you make any experiments yourself for the purpose of determining what was the most desirable high speed for the core, in the year 1908?

A. There was some experiments, but I don't know what it was.

x-Q. 688. And you haven't any idea of what was determined?

A. I haven't any idea. That's too—those things were changed back and forth, and I couldn't answer, I don't know what it was.

x-Q. 689. Can you tell me within 50 revolutions?

A. I wouldn't attempt to.

x-Q. 690. Do you know what was the reduction in high speed of the core made when the machine was removed from the attic, where the dry fabric was used, down to the floor, where the fresh fabric was used, in 1907 or 1908?

A. I don't know, don't remember.

x-Q. 691. Can you approximate it?

A. No, I could not.

x-Q. 692. You haven't any idea?

A. I haven't any idea what it was.

x-Q. 693. Have you any idea what the high speed was of the machine last used in the attic?

A. No, I have no idea of the last speed it was on.

x-Q. 694. You couldn't tell me within 50 or a hundred revolutions?

A. I wouldn't attempt to guess at it.

x-Q. 695. Did the experiments which you have described prove to you that the rate of high speed of rota-

tion of the core was an important factor in the production of satisfactory tires?

A. It was.

x-Q. 696. But you do not know what high speed you determined on for the commercial machine when you finished your experiments?

A. No, I can't tell you.

x-Q. 697. Did you determine that high speed?

A. No.

x-Q. 698. I am not asking you now what it was, but I mean were you the one who decided upon the high speed?

A. No.

x-Q. 699. Who was that?

A. I don't know.

x-Q. 700. Did you find out, as a result of your experiments, that the machine would not produce salable or usable tires if the stitcher-arm was pressed in only by the strength of the operator and no spring used; I mean pressed in laterally towards the core?

A. Pressed in against the side of the core?

x-Q. 701. That's what I mean.

A. You could have pressed it in hard enough to have made a tire that would have been all right.

x-Q. 702. Without the use of a spring?

A. Without the use of a spring.

x-Q. 703. Was the provision of a spring for this purpose an important feature of the machine?

A. It took the work off the man, and helped him to easier do his work.

x-Q. 704. And it made the stitchers act more uniformly, did it not?

A. It would act more uniformly.

x-Q. 705. So it was an important improvement over the mere pressing in of the stitcher by the hand of the operator?

A. Yes.

x-Q. 706. You spoke in your direct-examination of more pressure against the side of the core being desirable near the bead portion. Did you mean to limit that statement to instances in which the dry fabric was used, or does that fact apply even when fresh fabric was used?

A. The springs naturally—all the springs that were used naturally weren't as active as directly on the rolls when the core got narrower than when they were on the ball of the core, when they would add a little pressure by the hand to it.

x-Q. 707. Was that pressure intended to be enough to compensate for the loss of the spring pressure, or was it intended to make the total pressure at the bead section greater than that exerted at any time by the spring?

A. It added simply a little to the spring where it was narrow, where the tongue of the core was narrow.

x-Q. 708. Well, would you say that the actual pressure of the stitchers against the fabric on the sides of the core was greater under the influence of the springs and the hands of the operator at the bead section than higher up on the core?

A. No, I wouldn't say it was.

x-Q. 709. About the same?

A. About the same.

x-Q. 710. Did your experiments show that it made any difference in the operation of the stitchers whether the core was rotated in one direction or the other?

A. Yes.

x-Q. 711. Which direction was the proper one?

A. Toward the stitchers.

x-Q. 712. That is, so that the part of the core upon which the stitchers acted was moving downwardly with respect to the stitchers?

A. The core was moving downward rotating the stitchers—that is, over.

x-Q. 713. Is it not correct that you mean that the

377

part of the core upon which the stitchers were operating was moving downward?

A. Yes.

x-Q. 714. Did it make a very great difference if the core was rotated in the opposite direction?

A. Never tried it.

x-Q. 715. When you spoke of the flat springs for pressing on the stitcher-arms, you mentioned that they were frequently "getting set." Do you mean by that losing their spring?

A. Losing their spring.

x-Q. 716. Would the screw shown in Fig. 3 of "Sketch 14" advance the stitchers so that they would properly lay down the fabric?

A. A little slow, but it would lay it down.

x-Q. 717. It would do the work, but it would do it more slowly than a higher pitch?

A. Yes.

x-Q. 718. Do you mean to say that stitching-rollers with plain bearings would be entirely unsatisfactory and worthless in the first commercial machine?

A. With high-speed rotation they would.

x-Q. 719. And what do you mean by "high-speed rotation," approximately?

A. I can't state just the speed; but I know that just the hand-rolls alone, along when it was running about 50, would stick the roll; it would dry out; didn't dare put any oil on it, and it would stick and slide.

x-Q. 720. So that a high speed of 120 would make them worthless?

A. I would say it would.

x-Q. 721. In the operation of your first commercial machine at a high core speed of about 120, would stitchers mounted in plain bearings be impracticable?

A. They wouldn't be impracticable, but would wear out quickly.

x-Q. 722. They would do the work, but would wear out quickly?

A. Do the work; but would wear out quickly, wouldn't last any length of time at all.

x-Q. 723. Then do you mean to say that such rollers with plain bearings were not suitable for machine use?

A. They were not as good as the ball-bearing.

x-Q. 724. But they would work?

A. They would work.

x-Q. 725. Would they lay the fabric down as well?

A. I don't think it mattered.

x-Q. 726. Did you determine in your experiments any particular angle of the stitcher rollers, with respect to the plane of the core, that was best?

A. We experimented a great deal on the angle, but what the angle was itself I don't remember; I don't know the degree of the angle.

x-Q. 727. Who first suggested mounting the stitcher-rollers at a receding angle with respect to the plane of the core?

A. That was determined by the attempt to roll the fabric down and clear the skirt. The angle was put out as far as it could be and avoid hitting the skirt, to get as much pressure direct on the side of the core as you could possibly get.

x-Q. 728. Who determined that?

A. That was determined in our experiments.

x-Q. 729. Who conducted those experiments?

A. Three of us. That is,——

x-Q. 730. That is,——

A. The machinist——

x-Q. 731. Thomas, Wattleworth, and yourself?

A. Who?

x-Q. 732. Thomas, Wattleworth, and yourself?

A. No; Thomas,——

x-Q. 733. McDonald,——

A. McDonald.

x-Q. 734. And yourself? What did you mean by referring to the desirability of having the stitchers have a certain frictional contact with the skirts of the fabric to give radial stretch?

A. To give radial stretch to the fabric; that is, to stretch the fabric in radially.

x-Q. 735. And the contact of the outside of the stitching-rollers with the skirts of the fabric would have some tendency to effect radial stretch?

A. At high speeds it would.

x-Q. 736. Did you mean to say that the radial stretch in your first commercial machine was about 15% at the bead?

A. Yes.

x-Q. 737. How did you determine that?

A. Well, it was done by measurement.

x-Q. 738. How did you measure it?

A. I don't know how that was done.

x-Q. 739. You testified that the first machine which you put on the floor at the end of your experiments was commercially satisfactory, but that it was afterwards improved by reducing the high speed. When was that reduction made, about?

A. Well, I don't know.

x-Q. 740. Was it in the year 1908?

A. I couldn't answer when it was made. I don't remember.

x-Q. 741. Was it before the year 1909?

A. I couldn't answer that.

x-Q. 742. You don't know at all when it was?

A. I couldn't tell you when it was.

x-Q. 743. Was that machine improved in any other respects, that you remember?

A. No, I don't remember.

x-Q. 744. You testified that one of the objections to

the very high speed in the machine was the effect of starting and stopping the core.

A. Yes.

x-Q. 745. Did you observe the operation of the machine carefully, so as to satisfy yourself on this point?

A. I have seen it operated, yes.

x-Q. 746. But you did not observe what the high speed was?

A. Did not.

x-Q. 747. Well, what was the purpose of your observation, why were you observing it?

A. Why, it would throw a core off.

x-Q. 748. No; I mean why were you looking at it? Weren't you looking at it for the purpose of remedying it?

A. Watching the machine work.

x-Q. 749. And see if you could improve it?

A. And see what happened with the speed. Slip the core around, then you would have to take it out of the core and adjust it again.

x-Q. 750. But you didn't know what the speed was?

A. No.

x-Q. 751. Not even approximately?

A. No.

x-Q. 752. Did you guess at it, looking at it with your eye?

A. No, I wouldn't guess at it.

x-Q. 753. What was the name of the draftsman to whom you referred as making the drawings of the first commercial machine?

A. Charley Wattleworth. He did a great deal of it. There was one other draftsman, Percy something; I have forgotten his name now; was in my office at that time.

x-Q. 754. Do you personally know whether or not any of the drawings of this first commercial machine were destroyed in 1913?

A. I couldn't answer that.

x-Q. 755. Who made the sketches you produced this morning?

A. Mr. Harsel.

x-Q. 756. What's his first name?

A. William; William Harsel.

x-Q. 757. He is a draftsman in the employ of the Goodyear Company?

A. Yes.

x-Q. 758. And when did he make them, about?

A. Oh! the last week he has been making them.

x-Q. 759. Do you know what material he used in making them, from what he made them?

A. O, I made some pencil sketches on sheet of paper, about the outline, about the design; and he would work it up.

x-Q. 760. Is that all he had from which to make them?

A. That and the description of the experiment.

x-Q. 761. A written description?

A. No; just talked to him.

x-Q. 762. Did you give him any of the original drawings, or prints of them?

A. None whatever.

x-Q. 763. And you yourself remembered all the details of these sketches you produced?

A. Yes.

x-Q. 764. After the lapse of 12 or 13 years?

A. Yes.

x-Q. 765. Are you sure that the details of these sketches are correct?

A. As I remember them, they are correct.

x-Q. 766. Your memory is quite clear on it?

A. There on those sketches.

x-Q. 767. But you can't remember what the high speed of the first commercial machine was?

A. No, sir, I cannot.

x-Q. 768. There is no reason why you could not have seen the machine in evidence as Plaintiff's Exhibit No. 2 since the hearing at Cincinnati, if you had wished to do so, is there?

A. No reason; not that I know of.

x-Q. 769. Are you willing to let met see the few remaining drawings of the original drawings of the first commercial machine?

Mr. Rogers: Plaintiff's counsel inquires the purpose of counsel's request? Is it that he wishes to put them in evidence, or merely to inspect them?

Mr. Seward: I submit I don't have to answer that question, or decide my purpose, until I have seen them.

The witness: Yes.

x-Q. 770. Will you do so?

A. Yes.

Whereupon counsel for the plaintiff produced such drawings.

Mr. Seward: I offer in evidence the tracings just handed me by plaintiff's counsel, being Nos. 240M, 244M, 243M, 297M, 242M (B), 242M (D), 242M (C), 309M, 238M, 310M, 242M (A), 242M (E), and 308M, with the request that the said prints be attached and marked as one exhibit, Defendant's Exhibit X. I am perfectly willing that prints of these tracings may be substituted for the originals as the exhibits, so that the originals may be retained in the custody of plaintiff or his counsel.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 771. I understand that Mr. Wattleworth's full name is Charles Wattleworth; is that correct?

A. Yes, sir.

Rd-Q. 772. And he was the draftsman that collaborated with you, under your direction, and made many of the tracings that have just been introduced in evidence by defendant's counsel?

A. He was.

Rd-Q. 773. Did Mr. Wattleworth, in connection with your experimental work, operate under your direction?

A. He did.

Rd-Q. 774. Was his general mode of operation to work out suggestions made to him by you?

A. They were.

Rd-Q. 775. For instance, and purely by way of example, in connection with the screws that you used to advance the slide, did you suggest the use of a screw to him, and leave it to him to work out the proper form?

A. I did.

Rd-Q. 776. I suppose that, as already referred to by defendant's counsel, it is rather a difficult matter to remember exact dates and exact utterances to those who were associated with you, after a lapse of 12 or 13 years; is that correct?

A. Yes.

Rd-Q. 777. But, at any rate, you are sure that all of these experiments that have been testified to by you, and illustrated in your sketches were conducted and made prior to the time of the construction of the first commercial machine; is that correct?

A. They were.

Rd-Q. 778. And that first commercial machine, as indicated in part by the drawings that have just been intro-

duced in evidence, was constructed in the winter of 1907 and 1908; is that correct?

A. Yes.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. SEWARD:

Rx-Q. 779. During the years 1907 and 1908 both you and Mr. Wattleworth were employees of The Goodyear Tire & Rubber Company, were you not?

A. Yes.

Rx-Q. 780. And all these experiments, and the manufacture of the first commercial machine in 1907, or early 1908, were made at the expense of the Goodyear Tire & Rubber Company, were they not?

A. I don't know what the expense went to.

Rx-Q. 781. You don't know who paid the expense?

A. I do not, absolutely. It was simply—you make an order through; it was given a number, see? and it just went right through by number.

Rx-Q. 782. Who made the orders?

A. They were made in the Order Department.

Rx-Q. 783. Of the Goodyear Tire & Rubber Company?

A. Yes.

Rx-Q. 784. Did Mr. F. A. Seiberling oversee this experimental work?

A. No, he did not.

Rx-Q. 785. Did he, to your knowledge, attend many of the experiments?

A. No, he did not.

Rx-Q. 786. Did he attend any of them?

A. He saw some of it.

Rx-Q. 787. Did he make any suggestions for the experiments?

A. I don't remember of any suggestions.

Rx-Q. 788. Did he make any sugestions with regard to the manufacture of the first commercial machine?

A. Only we were permitted to go ahead with them.

Rx-Q. 789. But he didn't make any suggestions as to the detail of the construction?

A. No, he did not.

Rx-Q. 790. Or the general arrangement?

A. No, he did not.

Recross-examination closed.

Deposition closed.

Signature waived.

Adjourned until the following day at two o'clock P. M.

Resumed, pursuant to adjournment, July 8, 1920, at two o'clock P. M.

Present: counsel as before.

Whereupon FRANK A. SEIBERLING, the plaintiff herein, took the witness-stand in his own behalf; and, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, he deposes and says as follows:

Q. 1. Mr. Seiberling, you are the plaintiff in this suit?

A. I am.

Q. 2. And the President of The Goodyear Tire & Rubber Company?

A. Yes, sir.

Q. 3. How long have you been connected with that company?

A. Since its foundation in 1898.

Q. 4. Do you remember about when it was that you began to manufacture automobile tires of the kind here in controversy?

A. About 1903.

Q. 5. How were those tires made originally?

A. Originally were made by hand.

Q. 6. Will you state briefly what operation was performed?

A. Tire was made on a core that had been rubberized with a cement; a ply was stuck on, the core revolved in stages, and the ply stretched on by hand until it overlapped at the point of beginning.

Q. 7. This first step that you have described is the so-called "circumferential stretch", is it not?

A. Yes.

Q. 8. Can you state generally what the amount of that circumferential stretch was?

A. Well, it was approximately 10 or 12 per cent., or thereabouts.

Q. 9. Now, after the ply was stretched upon the core in the manner stated by you, how were the unattached skirts worked down on the core?

A. They were pulled down and stitched down with a little paddle, stitched with a hand-roller and finished.

Q. 10. What was the general character of the tool that the hand operator employed for this purpose?

A. He had a little paddle that he would use pushing down radially, with the idea of taking the flutings or wrinkles out.

Q. 11. In substantially the path shown in Plaintiff's Exhibit No. 7?

A. Yes.

Q. 12. Have you any idea of the amount of radial stretch that was thus imparted to the skirts of the ply in attaching it to the core?

A. It would be about the same or a little more than the circumferential stretch. Would be a little more than the circumferential stretch.

Q. 13. You know Will C. State, do you not?

A. Yes, sir.

Q. 14. Who was it that worked upon your first commercial machine?

A. W. C. State.

Q. 15. The same Mr. State who testified in this cause yesterday?

A. Yes, sir.

Q. 16. And is he the applicant upon whose application the patent in suit was granted?

A. Yes.

Q. 17. Do you remember when it was that State began his experiments on this machine?

A. In the year 1907.

Q. 18. Do you know what time of the year?

A. Well, it was the early summer of 1907. I will say in the summer of 1907; early summer of 1907.

Q. 19. Were you present in Akron at the time?

A. No, sir.

Q. 20. Where were you?

A. In Europe.

Q. 21. And when did you get back?

A. September, 1907.

Q. 22. Have you any means for assisting your recollection in this respect as to the fact that you were in Europe in the summer of 1907?

A. Why, I know that absolutely, if that's what you mean.

Q. 23. I direct your attention to a letter; and ask you to tell me, if you can, what it is.

A. It is a letter that I wrote from Milan, Italy, to my brother, August 12, 1907.

Q. 24. Without going into extreme detail, will you tell me the general purport of that letter?

A. I had learned of a machine used by Pirelli & Company, in Milan, known as the "Vincent" machine; and I had a talk with Pirelli about it; and I wrote my brother

concerning it, and stated that I thought of negotiating with Vincent for United States rights.

Q. 25. Did your brother make any reply to the letter?

A. He cabled me not to make any arrangement with him, that State had gotten up a machine that had excellent promise.

Q. 26. You happen to have that cablegram?

A. No, sir; not at this time; not at this time.

Q. 27. You, however, recollect the cablegram?

A. I recollect it. I got the cablegram in Paris when I got back there.

Q. 28. When did you say you returned to this country?

A. About the middle of September, 1907.

Q. 29. Do you recall whether or not you went in to look at what State was doing in connection with this projected machine?

A. I don't recall just the particular time. I saw the machine immediately upon my return, but the particular day I can't name.

Q. 30. You do remember, however, that you went in to look at it?

A. O, yes! I did that. Was very much interested in it.

Q. 31. When was it, Mr. Seiberling, that the machine was completed, if you recall, and put into commercial operation?

A. My recollection is, that the machine was being operated experimentally in the fall of 1907, and put into the factory, on the floor, in the winter or spring of 1908; I would say shortly after January, 1908.

Q. 32. Are you able to state whether or not your records show when that job was completed?

A. Our factory ledger shows that the first tire-building machine, No. 261, was completed, and the order on which it was built was closed out, date April 30, 1908.

Q. 33. I hand you another letter; and ask you to state, if you can, what it is.

A. Letter dated May 1, 1908, addressed to my brother, Charles W. Seiberling, Sandy Hook, New York, written by me.

Q. 34. Will you kindly state whether or not that letter refers to the commercial machine?

A. It does.

Q. 35. Will you kindly read the passage therefrom that relates to it?

A. "We are making close to 300 motor tires a day, the machine having turned out 60 with two men in 10 hours; and it looks as though we had the situation well in hand for the rest of the season."

Mr. Seward: I understand that letter is used to refresh his recollection only, and on that basis do not object to it.

Mr. Rogers: Yes.

Q. 36. What about the commercial success of this first machine?

A. It was a success from the start.

Q. 37. Was the quality of tires good that were made on it?

A. They were.

Q. 38. And was that machine subsequently duplicated by you?

A. It was.

Q. 39. Tell us, if you can, to what extent and who are the users of it.

A. Well, I made—I granted about approximately 50 licenses, and we made approximately 600 machines used by those licensees; and that type of machine has been in service from that time to this.

Q. 40. Are you able to state to what extent the Good-

year output of fabric tires has been made upon machines of this type?

A. Substantially exclusively from 1908 up to the present time.

Q. 41. Can you give me any idea of the number of tires that have been made upon machines of this type by the Goodyear Company?

A. Approximately 20,000,000.

Q. 42. And how many tires have been made by your various licensees of this machine during the same period, approximately?

A. An additional 40,000,000.

Q. 43. In other words, some 60,000,000 of tires have been made upon machines of this State type; that correct?

A. Yes, sir.

Q. 44. Have you any objection to telling us the amounts of royalties that you receive from your licensees?

A. No.

Q. 45. In the use of these machines?

A. No. They approximate $2,200,000.

Q. 46. How about the general rate of royalty that is paid you, and on what it is based?

A. The royalty is, graded as to size, and amounts to a fraction of one per cent. on the selling cost of the article; I mean on the selling price to the consumer.

Q. 47. What arrangement, if any, have you made with your licensees since the Court of Appeals for the Sixth Circuit handed down its opinion in the Firestone case, this being about December, 1918?

A. Commencing with approximately January 1, 1919, I have arranged with my licensees to pay one-half the royalties fixed in the contract, and the other half to be held in abeyance until there shall be a final determination respecting the validity of the patent.

Q. 48. Have you had any new licensees, or put out

any additional machines to licensees, since the period under discussion?

A. I have. I will say about a dozen.

Q. 49. Now, can you provide us with a list of the licensees who are using machines of this State type?

A. I can. I submit it herewith. The list of licensees is as follows:

Licensees.	Address.
The Amazon Rubber Company	Akron, Ohio.
Batavia Rubber Company	Batavia, N. Y.
Beacon Tire Company, Inc.	Beacon, N. Y.
Bowling Green Rubber Company	Toledo, Ohio.
The Brunswick-Balke-Collender Company	Chicago, Ill.
The Dayton Rubber Company	Dayton, Ohio.
Empire Rubber & Tire Corp.	Trenton, N. J.
The Federal Rubber Company	Cudahy, Wis.
The Fisk Rubber Company	Chicopee Falls, Mass.
G. & J. Tire Company	Indianapolis, Ind.
The General Tire & Rubber Company	Akron, Ohio.
The G. T. & R. Company of Canada, Ltd	Toronto, Ontario, Canada.
The Gordon Tire & Rubber Company	Canton, Ohio.
Geo. Grow Automobile Company	Boston, Mass.
The Hartford Rubber Company	Hartford, Conn.
The Henderson Tire & Rubber Company	Columbus, Ohio.
Hewitt Rubber Company	Buffalo, N. Y.
Howe Rubber Company	New Brunswick, N. J.
Ideal Tire & Rubber Company	Cleveland, Ohio.

Iowa Cord Tire Company....Des Moines, Iowa.
Kokomo Rubber Company...Kokomo, Ind.
L. & M. Rubber Company....Carrolton, Ohio.
Long-Wear Rubber Company. Elyria, Ohio.
The Marion Tire & Rubber Company .....Marion, Ohio.
The Mason Tire & Rubber Company .....Kent, Ohio.
The Mid-Continent Tire Mfg. Company .....Wichita, Kansas.
Morgan & Wright .....Detroit, Mich.
The McLean Tire & Rubber Company .....East Liverpool, Ohio
The McClaren Rubber Company .....Charlotte, N. C.
The McNaull Tire Company..Toledo, Ohio.
National Rubber Company...Pottstown, Penna.
The New Castle Rubber Company .....New Castle, Penna.
The Owen Tire & Rubber Company .....Cleveland, Ohio.
The Pharis Tire & Rubber Company .....Newark, Ohio.
The F. E. Partridge Rubber Company .....Guelph, Ontario, Canada.
The Portage Rubber Company .....Barberton, Ohio.
Rubber Products Company..Barberton, Ohio.
The Star Rubber Company..Akron, Ohio.
Stungo-Radium Rubber Company .....Washington, Penna.
The Swinehart Tire & Rubber Company .....Akron, Ohio.
The Victor Rubber Company. Springfield, Ohio.
Washington Rubber Company .....Washington, Penna.
Yale Tire & Rubber Company. New Haven, Conn.

In addition to this list, there are various foreign licensees who I included in my general statement that I had more than 50 licensees; the list above given comprises merely the American licensees.

Q. 50. You will recall the machine that was in evidence in the Firestone suit, which machine has been introduced in evidence in this suit as Plaintiff's Exhibit 2. Can you state what that machine was?

A. It was the first commercial machine to which I have referred.

Q. 51. You refer to the machine that you have already discussed as having been first operated in the early part of 1908?

A. Yes, sir.

Q. 52. Do you know whether or not that machine was in substantially the same condition as when first constructed and used?

A. It was.

Q. 53. How do you know that?

A. I know it from observation, and from the fact that I saw it almost daily while it was in operation in the factory; and it was taken from the plant to courtroom in Cleveland and set up and put in operation there in precisely the same shape as it was used in the plant.

Q. 54. Have you examined that machine carefully or closely during the last five years?

A. I have not.

Q. 55. But you did examine it about that time?

A. I did.

Q. 56. And your statement now that it is substantially the same machine was based upon your observation at that time?

A. Yes, sir, when it was exhibited in the courtroom in Cleveland.

Q. 57. Are you able to state how many tires were

produced on that machine before it was removed from service five or six years ago?

A. Approximately 150,000.

Q. 58. Those tires were of good quality?

A. They were.

Q. 59. Are the tires produced on that machine, and on the corresponding State machines you have already mentioned, of substantially the same kind as were previously made in the Goodyear plant by hand?

A. Yes, sir.

Q. 60. What is the amount of circumferential stretch of those tires, if you remember?

A. Around 10 to 12 per cent.

Q. 61. Would the remaining figures also hold, that the radial stretch is somewhat greater than that?

A. Yes, sir.

Q. 62. These two kinds of tires, one made by the "saw-tooth" hand method, and the other on the State machine, are the only tires that have ever been produced in any considerable quantity by the Goodyear Company; is that correct?

A. Yes, sir.

Q. 63. And in both of those classes of tires the amount of radial stretch is somewhat greater than, or approximately equal to, perhaps, the circumferential stretch?

A. Yes, sir.

Q. 64. Did you ever hear of any class of tire that used a different system of stretch?

A. Tires by some other manufacturers were made on machines that had a very much larger circumferential stretch than ours had, and practically no radial stretch.

Q. 65. Can you name any such machine?

A. Machines that were used by The Hood Rubber Company were of that general character.

Q. 66. How about the Vincent machine?

A. And the Vincent was of that character.

Q. 67. Referring to the Vincent machine, what vogue did it have in this country?

A. The Goodrich Company had one.

Q. 68. Do you know whether or not that machine is still being used by the Goodrich Company?

A. It is not.

Q. 69. Do you know what happened to it?

A. It was used one season for a short time, and then consigned to the scrap heap.

Q. 70. Do you know whether or not any of those Vincent machines are still in operation in this country?

A. None.

Q. 71. You say the tires made on the State machines are substantially the same as those made by the former hand method. Do you mean to imply that the quality is the same?

A. The qualities are higher, much better.

Q. 72. The quality of the machine-made tire is much better?

A. Machine-made tire is much better than the hand-made.

Q. 73. And in what particular respect, if any?

A. Principally on account of its uniformity.

Q. 74. State what was the practice in the Goodyear plant in using the spinning-rolls of the State machine to form around the bead.

A. In the early days we used the rolls in going clear around the bead.

Q. 75. And how about later days?

A. Later we run it down to the bead, and had a separate process for going on the lower side of it.

Q. 76. In other words, in the earlier times the State rolls were used to go about the bead, and then in later times you used some other appliances?

A. Yes, sir.

Q. 77. How many tires a day can you make on the State machine?

A. The capacity of the State machine was about six tires per hour for the average man, using a 4-inch tire.

Q. 78. That is to say, in a 10-hour day you would make 60 4-inch tires?

A. Yes. That was in the early days. That has been improved on since.

Q. 79. And how many tires a day could be made by an operator using the old hand method?

A. He would average about six tires a day.

Q. 80. In other words, roughly speaking,——

A. Made as many per hour on the machine as you could make in a 10-hour day with a man.

Q. 81. Or, putting it another way, the machine capacity is about ten times that of the hand capacity?

A. Exactly.

Q. 82. As I understand the situation, the earlier tires made by the Goodyear Company were chiefly clincher tires; is that correct?

A. That's right.

Q. 83. And later on you began to make more straight-side tires?

A. Yes, sir. We have always made more clinchers than straight-sides, but the proportion of straight-sides was growing relatively to clinchers as time ran.

Q. 84. Why was it the Goodyear Company has preferred the combined circumferential and radial stretch method to the single circumferential stretch method in the manufacture of tires?

A. Because the fabric when applied is under less tension, and it makes a stronger carcass.

Q. 85. State whether or not you have succeeded in getting a more uniform stretch by the combined stretch method than by the single circumferential stretch method.

A. Well, more uniform as to the sheet of fabric.

Q. 86. Are you still using the State machine in practically its original condition in the Goodyear factory?

A. Yes, sir.

Q. 87. To the same extent as formerly?

A. No, sir.

Q. 88. In other words, you are using a different form of machine also?

A. We have perfected a new type that is a single-unit machine, permitting but one operator, instead of two, and taking less floor space than the State machine.

Q. 89. You mean by that that each machine is provided with a single head, do you not?

A. Yes.

Q. 90. Whereas, in the old type of State machine it was provided——

A. Arranged for two operators; two heads for two operators.

Q. 91. Now, is the general State combination preserved in these improved machines?

A. Yes, sir.

Q. 92. I refer more particularly to the advancing table, or slide; the arms mounted thereon, and which carry the stitching-rolls; means for imparting inward or lateral pressure to the arms, so as to force the rolls against the core; and means for advancing the slide inwardly toward the core, so as to cause the rolls to traverse the core, and the fabric thereon, radially. Are these various features all continued in your improved machines?

A. They are.

Q. 93. There are also high and low speed devices therein, and speed-changing mechanism?

A. There are.

Q. 94. Will you state, as briefly as you can, some of the improvements that have been embodied in this new ma-

chine? For instance, what form of pressure is applied to the stitcher-arms?

A. Air pressure.

Q. 95. Instead of the springs on the early State machine?

A. Springs, yes, that we had before.

Q. 96. Are the means for releasing this pressure, at the time——

A. Automatically.

Q. 97. That the roll has completed its traverse inwardly across the core surface?

A. Automatically.

Q. 98. And are there any automatic means in it for separating the rolls?

A. There are.

Q. 99. So as to enable them to be restored to their original or outward position?

A. The head of the machine is automatic throughout: carriage moved forward on its trip; automatically returns; and pressure is automatic; and releases automatically; and the machine is an independent unit for one operator.

Q. 100. How about the bead-setter; how is that operated?

A. That operates pneumatic pressure.

Q. 101. And how is the drive controlled?

A. The drive is controlled by electricity; by merely touching knobs, we get the speeds—touching buttons, we get the speeds.

Q. 102. Where was it that the experiments leading up to first State commercial machine were performed, if you recollect?

A. In Akron, Ohio, in the attic of our old Shipping Room Building.

Q. 103. Can you state what the records of your com-

pany show as to the time of employment of one Cary D. Derry?

A. Our record shows that Cary D. Derry, residing at 376 East Voris Street, was employed by the Company April 13, 1908, as a tire-builder, and left August 5, 1908.

Direct-examination closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 104. How do you figure the radial stretch obtained in the hand-making of tires? I mean, How do you know it was a little more than the 10 or 12 per cent. circumferential stretch?

A. By measurement.

x-Q. 105. Did you measure that yourself?

A. No; but I have been with them when they were experimenting and testing it, and that's my observation.

x-Q. 106. Have you carefully observed others measuring them?

A. Yes.

x-Q. 107. Did you see the result of the measurement?

A. Yes.

x-Q. 108. Then you know that to be a fact?

A. I do.

x-Q. 109. Does this same apply to the amount of radial stretch on the machine-made tires?

A. Yes.

x-Q. 110. You know that to be a fact?

A. Yes.

x-Q. 111. From observation?

A. Yes.

x-Q. 112. Will you state what time in the year 1907 you left for Europe?

A. About——

x-Q. 113. I am referring to the trip on which you mentioned you were in Italy.

A. About June 11th.

x-Q. 114. So you were abroad between three and four months?

A. I was abroad 13 weeks.

x-Q. 115. Will you please write into the record, or have copied into the record, the letter that you wrote from Milan to your brother on August 12, 1907, to which you have referred?

Mr. Rogers: Counsel for the plaintiff objects to the question, for the reason, as clearly stated in the record, the letter was used simply for the purpose of refreshing the recollection of the witness, and was not introduced in evidence.

A. I have no objection to doing so.

x-Q. 116. Will you please do so?

Mr. Rogers: Counsel for plaintiff objects to the question, for the reason previously stated; and gives notice that, at proper time, he reserves the right to move for the expunging of the entire testimony on cross-examination relating to this matter.

Mr. Seward: I also offer this letter in evidence, with the request that it be marked "Defendant's Exhibit Y."

Mr. Rogers: Same objection to the offer, and same notice.

Mr. Rogers: Plaintiff's counsel further objects to the subject-matter of the letter as being mere hearsay related by the witness in a private letter.

A. Said letter reads as follows:

Heading of Palace Hotel, Milan, Italy.

"MILAN, le 8/12 1907

"MY DEAR BROTHER:—

"I have just come from a meeting with Mr. Perelli. They have one of the tire machines invented

by a Frenchman which makes 4 tires per hour up to the cover. He claims it works perfectly putting the fabric on at uniform tension, the beads accurately located, with a saving in material. He was not permitted to show it to any one in the absence of an order from the inventor since he has no American patents. He says Goodrich have two of them and that the inventor was in America sometime ago starting them. They were sold under a guaranty to make 4 tires per hour as perfect as a sample submitted. Price of one set of machines to be 6,000 with a royalty of 1% on selling price, and a minimum guaranty for a period of years,— Perelli is going to give me a letter to the inventor. Now I am inclined to negotiate for one machine with the right to require more as needed and figure that we can make 100 tires a day, in much less space than we are now making 200, besides doing it better,— provided nothing has been developed in my absence that shows we can do substantially as well on our own line,—Perelli is averaging almost 5 tires per man per day and is making more than 90% of his product on the machine. Talk the matter over with Litchfield and Stadleman, and cable me Western Union Code what you think of it to Paris. Both Work and Marks have been here, and Perelli stayed a week at Works house about a year ago. They employ 3900 people largely on insulated wire; Tires being a small part of their business.

"As I have not heard a word from anyone for over a month I will cable you from Geneva if I do not find any letters there, being particularly interested in your financial situation.

"Sincerely,

FRANK."

"All Well."

x-Q. 116. You have no copy, I understand, of the cabled reply to this last-named letter?

A. I have not.

x-Q. 117. Are you sure that that cable referred to the machine as State's machine?

A. Yes, sir.

x-Q. 118. Do you remember the wording of the cable substantially exactly?

A. Substantially this: "Stadelman and I advise no arrangement with Vincent. State has made excellent progress with his machine; promises well."

x-Q. 119. What was the high speed of the core on that machine you have referred to as the first commercial machine, that was completed April 30, 1908?

A. I don't know exactly. Around 200, I should say.

x-Q. 120. What was the low speed of the core?

A. O, around 15! About 15.

x-Q. 121. Do you mean to testify that the 50 licensees to which you have referred have used machines which were actual duplicates of that first machine?

A. No, sir.

x-Q. 122. And, when you refer to the 20,000,000 tires made by the Goodyear Company, and the 40,000,000 made by your licensees, you do not refer to the use of machines exactly like that first machine, do you?

A. I do not.

x-Q. 123. And the 40,000,000 tires to which you have referred are the ones from the manufacture of which you have received the royalties which you have stated as in the neighborhood of 2,200,000; is that correct?

A. Yes, sir.

x-Q. 124. Were those agreements with those 50 licensees in writing?

A. Yes, sir.

x-Q. 125. Were they all uniform prior to January 1, 1919?

A. Yes, sir.

x-Q. 126. Exactly?

A. Yes, sir. Oh, no; pardon me! The license of the Fisk Company, the first one that I made, was slightly different in terms from the remainder.

x-Q. 127. What was the particular difference?

A. The only difference was as to the time when the royalties were to apply to absorb the advance royalties on the machine.

x-Q. 128. Did the licenses—I mean these agreements with these 50 licensees—also grant a license under the Seiberling and Stevens patent No. 726,561, dated June 14, 1904?

A. They did.

x-Q. 129. And the royalties to which you have referred were paid for the license under these two patents?

A. Yes, sir.

x-Q. 130. The license agreements did not discriminate between the two patents as to the royalty payments, did they?

A. No, sir; except that the royalties were to continue, after the expiration of the Seiberling and Stevens patent, to the full amount, to the expiration of the State patent.

x-Q. 131. Now, the licenses that you have granted since January 1, 1919, were they written agreements?

A. Yes, sir.

x-Q. 132. Is the royalty rate exactly half of that provided in the former license agreements?

A. Yes, sir. No, the royalty rate is the same; I am merely holding half in abeyance. The rate is the same. I am holding up one-half of it until the validity of the patent is determined.

x-Q. 133. When you say you are holding up one-half of it, you mean each licensee withholds one-half?

A. Exactly. I am permitting them to withhold one-half until the validity of the patent shall be determined.

x-Q. 134. How is the question of the validity of the patent to be determined under these agreements?

A. By a final decision of the highest court of appeal.

x-Q. 135. You mean the United States Supreme Court?

A. The United States Supreme Court.

x-Q. 136. And, if the validity of the patent is not sustained, the licensees do not have to pay this half of the royalty?

A. No, they do not.

x-Q. 137. Have the licensees, since January 1, 1919, been provided with machines embodying improvements over the first commercial machine?

A. Some of them have.

x-Q. 138. Have any of them been provided with machines just like the first commercial machine to which you have referred?

A. Four-fifths of the machines were of the type of the first machine I have referred to.

x-Q. 139. Do you mean they were just like the first comercial machine?

A. Can't say that they were absolutely alike in every particular. They were made from the same patterns and were alike in their design and function.

x-Q. 140. How about the high speed of rotation of the core? Was that the same in these machines provided licensees since January, 1919, as in the first commercial machines?

A. No, that was subsequently reduced.

x-Q. 141. That was reduction to a speed around 120 or 130 r.p.m. was it not?

A. I think it was about that.

x-Q. 142. And that reduction was made as far back as 1908, wasn't it?

A. No.

x-Q. 143. When was it made?

A. Considerably after that. I can't tell you exactly when. We made gradual reductions in the speed of the core as we found it advantageous.

x-Q. 144. Do you remember when the high speed of the core was first reduced in the first commercial machine?

A. I do not.

x-Q. 145. Can you approximate the date?

A. I think the speed was reduced after we made our first machine to about 150.

x-Q. 146. That is, the speed in the second was made about 150?

A. That's my recollection.

x-Q. 147. And about when was that second machine built?

A. Well, we commenced getting them on the floor in 1909.

x-Q. 148. Didn't you have more than one commercial machine on the floor in 1908?

A. I can't tell you about that. I can ascertain it, but I can't tell you now.

x-Q. 149. Your recollection is not at all clear on that?

A. Well, my recollection is, that we commenced getting additional machines on the floor early in 1909.

x-Q. 150. That would be how early in 1909 about?

A. Well, very early in 1909.

x-Q. 151. January, probably?

A. Yes, very early in 1909.

x-Q. 152. And do you remember when the high speed of the core was first reduced to about 150?

A. I do not.

x-Q. 153. Can you approximate the date?

A. I should say three years ago.

x-Q. 154. That is, since the trial of the case against Firestone Company?

A. Yes.

x-Q. 155. Have some of the machines that have been provided the licensees recently,—that is, since January, 1919,—embodied one or more improvements shown in one or more patents other than the State patent in suit, and owned wholly or in part by you, or under your control?

A. I don't know at the present time; but I will look it up and advise Mr. Rogers, and he will advise you of my answer.

x-Q. 156. Is The Howe Rubber Company, of New Brunswick, New Jersey, one of your licensees now?

A. Yes, sir.

x-Q. 157. Are you sure of that?

A. I executed a license to them.

x-Q. 158. Did they accept this modified form of license that you have referred to as being in force since January 1, 1919?

A. I can't say as to that definitely, but I will ascertain and let you know.

x-Q. 159. Have you any doubt about any of the other licensees listed here?

A. I haven't any licensee who has, to my knowledge, refused to accept the modification.

x-Q. 160. Does your knowledge extend to the fact whether or not all of them have?

A. I would have to check that to give you exact information on it; which I will do, and advise you through Mr. Rogers before the close of the rebuttal testimony.

x-Q. 161. And will you please indicate which of these licensees had a license before January, 1919, and which are the new licensees that you have referred to?

A. I will.

x-Q. 162. And provide me the information for the record in the same way?

A. I will.

x-Q. 163. Several of these licensees are owned or con-

trolled by a single corporation, The United States Tire Company, or The United States Rubber Company, are they not?

A. Yes, sir.

x-Q. 164. Will you please name those?

A. The G. & J., Morgan & Wright, and The Hartford Rubber Works Company.

x-Q. 165. Have all the licenses of this new form which you have brought out since January, 1919, been uniform?

A. Yes, sir.

x-Q. 166. That is, their terms are the same?

A. Yes, sir.

x-Q. 167. Do you remember what was the low speed of core rotation of the first commercial machine at the Goodyear plant to which you referred?

A. I think it was approximately 15.

x-Q. 168. I believe you have testified that that machine, Exhibit No. 2 as put in evidence, is in substantially the same condition as it was originally used?

A. I have.

x-Q. 169. Do you mean as it was originally used in the attic to which you have referred, or as originally used on the floor?

A. Used on the floor.

x-Q. 170. After it was removed from the attic?

A. Yes.

x-Q. 171. Do you know what the high and low core speeds are for that machine, Exhibit 2? I mean, Do you know that they are the same as the speeds which you have given for the first commercial machine?

A. You are referring to that particular machine, are you?

x-Q. 172. I am referring to the particular machine in evidence.

A. You are asking me for absolute knowledge, and I haven't got it. And I haven't.

x-Q. 173. Isn't it a fact that some changes were made in that machine before it was put in evidence in Cleveland, in order to return it to its original condition?

A. That is a fact.

x-Q. 174. Do you mean to state that it is literally a fact that you saw that machine almost daily in operation from 1908 down to the time it was put in evidence in Cleveland?

A. Yes, sir.

x-Q. 175. Weren't you away from the factory months at a time?

A. Yes. Not months at a time, no. Yes; that is, I was away one period for five weeks in the interim.

x-Q. 176. How many times were you abroad in the interim?

A. Once.

x-Q. 177. Is that the period to which you referred?

A. Yes, sir.

x-Q. 178. How do you figure the answer which you have given, that about 150,000 tires were made on that machine?

A. I looked up the record at the time I testified in the case before Judge Kilitts, and found that the machine had made over 150,000 tires.

x-Q. 179. Did you ever see the Vincent machine in the plant of the Goodrich Company?

A. I did not.

x-Q. 180. Do you mean to testify of your own knowledge that it was only used part of one year and then thrown in the scrap heap?

A. No, sir.

x-Q. 181. When you say that the stitching-rollers of the first commercial machine were used for turning the fabric clear around the bead, do you mean that they actually tucked the fabric all the way into the tongue of the core along the bottom of the bead?

A. Yes, sir.

x-Q. 182. So that no hand operation was required whatever?

A. No, sir, no hand operation was required.

x-Q. 183. Were the spinning-rolls in that machine set at a receding angle to the plane of the core?

A. They were.

x-Q. 184. And that angle was acute toward the outer periphery of the core?

A. Yes, sir. The operator, by a slight pressure on the handlebars at the moment of rolls reaching the top of the bead, enabled the carriage to move on around to the bottom of the bead, rolls turning in the fabric all the while.

x-Q. 185. Did the rolls operate at that time with their edges or with their sides?

A. With their edges and sides.

x-Q. 186. Why did you stop operating the machines in that way at the Goodyear plant?

A. Because the construction of that time did not make as good a job as we could get by a separate tool.

x-Q. 187. You have referred to a new type of machine that, you say, has been perfected at the Goodyear plant, and have mentioned some of the improvements. Does one of those improvements which you have not mentioned consist in an arrangement for changing the angle of the spinning or stitching rollers with respect to the plane of the core?

A. It does.

x-Q. 188. Are there any other improvements that you can remember besides those mentioned?

A. I have given you the essential improvements, the most important improvements.

x-Q. 189. You don't remember any others just now?

A. No, I do not.

x-Q. 190. Will you tell me about what the high speed of the core is in these new machines?

A. About 125.

x-Q. 191. And about what's the low speed?

A. About 12.

x-Q. 192. Will you state whether or not the Goodyear Company has, by contract with you, a fixed interest in the royalties which you have referred to as being received under your license arrangements?

A. They have.

x-Q. 193. How long has that been a fact, about?

A. From the beginning.

x-Q. 194. That is, from the year 1908 or 1909?

A. Yes, sir.

x-Q. 195. Can you say whether the experiments which you have referred to as being conducted in the attic were at the expense of the Goodyear Company?

A. They were.

x-Q. 196. The Goodyear Company has never paid you any royalty under license, has it?

A. They have not.

x-Q. 197. Have you been the sole licensor in all the license agreements to which you have referred?

A. I have.

x-Q. 198. Are you willing to produce and let me see a copy of the form of license agreement that you have been using since January, 1919?

A. I am.

x-Q. 199. Are you willing that I should put one in evidence, if I should see fit, after examining it?

A. I am.

x-Q. 200. Will you ask Mr. Rogers to let me see a copy at the same time that he provides me with the other information already referred to?

A. I will.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 201. You have stated that some of the machines that have been provided to your licensees have contained various improvements on the original form of State machine. I should like to have you state whether or not any of these machines furnished your licensees do not contain the following elements: a high-speed core; a slide, and means for advancing it; stitcher-arms, and stitchers mounted on the slide; and pressure devices for forcing the stitchers against the side of the core.

A. All of them contain the features named.

Rd-Q. 202. Do all of them also contain a high and low speed mechanism for the core, and speed-change mechanism?

A. They do.

Rd-Q. 203. You have displayed some lack of memory as to certain features and incidents occurring in 1907, 1908, and 1909. In this connection you have stated that possibly the speed of the core in the machines put on the floor in 1909 was about 150. Do you mean to state definitely that this lowered speed was obtained as early as 1909?

A. I do not.

Mr. Rogers: Plaintiff's counsel, without waiver of objection previously noted, will now examine the witness as to the disputed letter of August 12, 1907.

Rd-Q. 204. Mr. Seiberling, at the time you wrote the letter of August 12, 1907, had you seen a Vincent machine?

A. I had not.

Rd-Q. 205. Then the statements that were made in that letter concerning the utility and value of the Vincent machine were based entirely on hearsay?

A. Entirely on information that I had received from Mr. Pirelli, who stated that he was part owner in the patent.

Mr. Rogers: Counsel for plaintiff states that, for the reasons stated in the last two answers of the

witness, he further objects to the consideration of the letter, or its introduction in evidence; and shall also advance the ground of hearsay in connection with his motion to strike out the evidence and the exhibit.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. SEWARD.

Rx-Q. 206. At the time you wrote that letter of August 12, 1907, were you President of The Goodyear Tire & Rubber Company?

A. I will have to answer that by saying my recollection is, I was first elected President in 1908.

Rx-Q. 207. And at that date of August 12, 1907, were you an officer of the Goodyear Company?

A. I was a director and General Manager.

Rx-Q. 208. What position did your brother to whom you wrote that letter hold?

A. He was Secretary.

Rx-Q. 209. Of the Goodyear Company?

A. Yes, sir.

Rx-Q. 210. Mr. Litchfield whom you mentioned in that letter was an officer of the Goodyear Company; or, if not, what position did he hold?

A. He was Superintendent of the factory.

Rx-Q. 211. And Mr. Stadelman whom you mentioned——

A. Was Sales Manager.

Rx-Q. 212. Of the Goodyear Company?

A. Yes, sir.

Rx-Q. 213. The gentlemen Work and Marks whom you mentioned in the letter were connected with The B. F. Goodrich Company, were they not?

A. No; Marks was Factory Manager of The Diamond Rubber Company, and Work was President of the Goodrich Company.

Rx-Q. 214. And when you mentioned in this letter negotiating for one machine, you referred to the Goodyear Company negotiating, did you not?

A. Yes, sir.

Rx-Q. 215. Were you here at any time yesterday during the taking of Mr. State's testimony?

A. No, sir.

Recross-examination closed.

RE-REDIRECT-EXAMINATION BY MR. ROGERS:

R-rd-Q. 216. Is Will C. State now employed by the Goodyear Company and who conducted the experiments for the first Goodyear commercial machine the same Will C. State who assigned his application for a patent, which patent issued to you and is the patent in suit?

A. He is the same one.

R-rd-Q. 217. Is there more than one Will C. State connected with the Goodyear Company?

A. There is not.

Re-redirect examination closed.

Deposition closed.

Signature waived.

Adjourned until 11 o'clock A. M. of the following day.

Resumed, pursuant to adjournment, at 11 o'clock A. M. of July 9, 1920.

Present: counsel as before.

Whereupon ARTHUR R. MACKEY, the next witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers deposes and says as follows:

Q. 1. Please state your name and residence.

A. Arthur R. Mackey; 892 Johnston Street, Akron, Ohio.

Q. 2. What is your present occupation, Mr. Mackey?

A. General contractor.

Q. 3. And how long have you been engaged in that line of business?

A. 10 years.

Q. 4. Were you ever in the employ of the Goodrich or Diamond tire companies?

A. Yes, both of them.

Q. 5. Can you state about when that was?

A. I was at the Goodrich two different periods. In 1906 or 1907. It was at the time of the 1907 panic I was laid off for a few months; and was sent for, and went back again at the Goodrich; worked there for a few months more, and left there on account of all night work and went to the Diamond.

Q. 6. And when was it you went to the Diamond, what year about?

A. It was about 1908 or nine; between 1907 and nine, as near as——

Q. 7. What was your position at the Diamond, Mr. Mackey?

A. When I first went there, I was a tire-builder; and afterwards an inspector of tire construction.

Q. 8. I suppose you have both made tires yourself and seen many of them made at the Diamond plant?

A. Yes, sir.

Q. 9. What was the official and authorized way of making tires at the Diamond plant by hand?

A. Why, by pulling on the plies as near as straight as possible upon the core, with about as much strength as a person had to pull them on with. Sometimes you had to pull them more than once. And stitching them down with a fine stitcher by hand.

Q. 10. What do you mean by "stitching them down"? How was the operator supposed to work the tool in stitching them down?

A. Why, you held your ply over your fingers with the left hand and stitched down with the right hand in a diagonal way across the ply, from the side of the core down toward the bead.

Q. 11. Do you mean somewhat in the manner indicated in Plaintiff's Exhibit No. 7?

A. Yes, sir.

Q. 12. You understand what I mean when I call that, for purposes of convenience, the "sawtooth" method?

A. Yes, sir.

Q. 13. You say that the sawtooth method was the official or recognized method at the Diamond plant. Was there any other unofficial method employed there for forming the sides of the ply to the core?

A. There was.

Q. 14. What was that?

A. We first stretched the ply of fabric on the core, and then spun the core as rapidly as we could by hand, and then rolled the fabric down on the side of the core by a stitcher held in the hand of the operator, moving the hand inwardly down toward the bead. When the plies were stretched on tight and even, we could spin down to the bead, and sometimes out to the heel of the bead.

Q. 15. You say this was an unofficial method employed in the Diamond plant. Do you mean that this handspinning method you have last described was not officially prescribed in the Diamond plant?

A. It was not the method taught to be practised in the Diamond at that time.

Q. 16. What was the method that was taught to be practised there?

A. The method heretofore spoken of as the "sawtooth" method.

Q. 17. Have you yourself made tires in the Diamond plant by this unofficial handspinning method?

A. Yes, sir.

Q. 18. Under what circumstances did you make them? Did you do it in the presence of those in authority over you?

A. Well, it wasn't done in their presence.

Q. 19. Do you remember the conference I had with you a few weeks ago?

A. Yes, sir.

Q. 20. What did I ask you to do at that time?

A. Well, first you asked me if I could make tires as I had done during those days of tire construction; and I said that I could. And you also asked me if I would, and I said I would. Then a date was set; and I met at the Goodyear; and they conducted me to the Experimental Department, and gave me cores and plies; and they asked me to make tires by this handspinning method, as near as I could, as I had done before.

Q. 21. And how many of those tires did you make in that way, if you recall?

A. During the entire time?

Q. 22. Yes?

A. In the neighborhood of 20; between 20 and 25.

Q. 23. How were these tires marked which you made by the handspinning method in the Goodyear plant within the last 60 or 90 days?

A. They were marked with a red-paint numbering, "1" to "10," and with a letter initial "M" on each tire.

Q. 24. Now, when I asked you to make these tires by the hand-spinning method at the Goodyear plant, what request or instructions did I give you?

A. Well, the words, as near as I can recall them, are, "Now, you are the boss; tell us what you want, and make them as near as you did at the Diamond years ago."

Q. 25. Did I tell you to make them of as good quality as you could?

A. Yes, sir, when we started. Then you stated, "Well, make them just as good as you can."

Q. 26. You first made a few experimental tires, did you not, to determine whether or not your hand had its previous skill; that right?

A. Yes, sir.

Q. 27. And then, if I am correctly advised, you made a first set of 10 tires?

A. Yes, sir.

Q. 28. Do you recall any difficulty that occurred in connection with that first set of 10 tires?

A. Yes; through an error of the man that brought the fabric, he brought 4½-inch tire fabric to be used on a 4-inch core; which was much heavier than the 4-inch fabric; and they all buckled in the mold, pinched in the mold.

Q. 29. And then, if I am advised correctly, you started in and made a second set of 10 tires with different and more appropriate material? Is that correct?

A. Yes, sir.

Q. 30. And these were all made by the handspinning method, in substantially the way that you used to make them in the Diamond plant, and with as much skill and ability as you were able to exert upon them?

A. Yes, sir.

Direct-examination closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 31. When did you leave the Diamond plant?

A. It was during nineteen—let's see. It was about the year 1909.

x-Q. 32. Where did you go from there?

A. Went to contracting.

x-Q. 33. Been a contractor ever since?

A. Yes, sir.

x-Q. 34. What line of business?

A. General contractor.

x-Q. 35. Have you specialized in any line?

A. Well, dwellings and brick.

x-Q. 35A. Building materials?

A. Buildings, yes, all buildings, construction.

x-Q. 36. That's been chiefly your line? Have you been engaged in any tire-manufacturing concern since 1909 until you made these experimental tires?

A. Yes, I worked a couple of months, I think, at the Firestone plant.

x-Q. 37. When was that?

A. Well, now, the exact date I can't tell you; but it was at the completion of their new building on Main Street, when they moved from Sweitzer Avenue to Main Street.

x-Q. 38. Was that soon after you left the Diamond?

A. O, that was in about a year!

x-Q. 39. What did you do at the Firestone?

A. Make tires.

x-Q. 40. Inspector or tire-builder?

A. Builder.

x-Q. 41. Now, from that time when you were at the Firestone until you built these tires at the Goodyear plant two or three months ago, had you made any tires?

A. I had not.

x-Q. 42. Why did you leave the Diamond plant?

A. Well, I left the Diamond plant because of a personal disagreement with the foreman.

x-Q. 43. And why did you go into contracting business after leaving the Diamond, instead of going to some other tire concern?

A. Well, after leaving the Diamond I went to work at carpenter work for a contractor; and he hadn't been very long at contracting, and was making considerable money; and during that same summer I bought a lot and started a house for myself; with the assistance of foreman for instructions, I soon built the house, and sold it,

made several hundred dollars on it, and saw that it was a good game; so I went right at it and contracted ever since.

x-Q. 44. Why did you go to the Firestone for the two months?

A. It was about Christmas time, and the weather was very bad, we couldn't work out. It was a very heavy snow, a heavy winter. And I worked there until the 1st of March, because it was inside.

x-Q. 45. Did you leave Firestone of your own accord?

A. I gave them notice, and left there to start building that I had under way.

x-Q. 46. And you held no other position than that of a tire-builder while you were at the Firestone?

A. I did not.

x-Q. 47. What size tires were these that you recently made at the Goodyear plant?

A. 34 by 4.

x-Q. 48. All the same size?

A. All the same size.

x-Q. 49. Clincher or straight-side?

A. Straight-side.

x-Q. 50. With the wire bead?

A. Well, the beads were wrapped; I didn't see what they were.

x-Q. 51. Inextensible bead?

A. Yes.

x-Q. 52. Who was with you while you made those tires?

A. A man by the name of Albert Shaw and a man by the name of Mr. Ray.

x-Q. 53. Anybody else?

A. No.

x-Q. 54. Were those men present while you made all the tires?

A. Practically so.

x-Q. 55. And no one else was present while you made any of the tires?

A. Why, Mr. Trogner of the Goodyear came over from his office and watched—seen two or three of them made. Mr. Rogers was there at the starting of the tires to witness my skill, but not at the time of the 10 tires that were made for official exhibit.

x-Q. 56. Mr. Rogers was there while you were making one or two of the first tires?

A. First one or two tires.

x-Q. 57. Now, can you recall anybody else who was there while you were making any of the tires, any of the 20 or 25?

A. Why, there was other men working about the room; but, then, there was none of them that came and made it their business to——

x-Q. 58. Did any of them stand and observe you, or make suggestions to you, or talk with you about the making of any of those tires?

A. No. There was one man there that talked to me several times during the construction of those tires, but not of the tires; it was other business.

x-Q. 59. Who brought you the fabric?

A. A man by the name of Al Shaw was the one that brought it to me.

x-Q. 60. Who brought you the beads?

A. Mr. Shaw.

x-Q. 61. Now, did you yourself put on all the plies of all of those tires?

A. I did.

x-Q. 62. You did all the stretching?

A. I did.

x-Q. 63. You did all the stitching?

A. I did.

x-Q. 64. You put the beads on?

A. All but a few. Mr. Shaw put on a few of them.

x-Q. 65. About how many tires did Mr. Shaw put the beads on?

A. O, I presume Mr. Shaw put four or five beads on out of the last 10.

x-Q. 66. What kind of a device did you and Mr. Shaw use for putting the beads on?

A. They had a cast ring, or an iron ring, that was made to fit over the base of the core to place the bead the proper place.

x-Q. 67. You had one of these rings for each side of the tire, didn't you?

A. Yes, sir.

x-Q. 68. Were they held on by clamps?

A. No, they just—they were made to fit the bolt-ring of the core. They just set in——

x-Q. 69. By the "bolt-ring" you mean the ring that holds the sections of the collapsible core together?

A. Yes, sir.

x-Q. 70. By "collapsible core" you mean a core which is made in several pieces, instead of being a solid ring?

A. Yes, sir; held together with two rings bolted on each side.

x-Q. 71. Those rings being connected with the tongue of the core?

A. Yes, sir.

x-Q. 72. Were the rings which were used to place the beads left in position while you did any stitching?

A. They were not. Just a minute! You mean the stitching of plies?

x-Q. 73. Stitching of plies?

A. No.

x-Q. 74. Were they left in position while you rolled the beads?

A. Yes, sir.

x-Q. 75. What kind of a tool did you use for rolling the beads?

A. Quarter-inch—a stitcher quarter-of-an-inch face.

x-Q. 76. With a groove in the face?

A. No.

x-Q. 77. A plain cylinder?

A. A plain stitcher; a stitcher of about an inch and a half, inch and three-quarters, in diameter, with a quarter-inch face.

x-Q. 78. A flat face?

A. Flat face.

x-Q. 79. Did you use any other tool for rolling the beads?

A. We used the—now, on those beads they had a sort of a flap strip that came up on to the plies a little ways, and we used a two-inch roller in rolling that down.

x-Q. 80. Was that flap strip folded from the tongue of the core outwardly?

A. No; it was from the top of the bead up on to the ply possibly an inch.

x-Q. 81. Towards the periphery of the core?

A. Towards the tread of the core.

x-Q. 82. That was the two-inch cylindrical roller that you used for rolling that flap strip down?

A. Yes.

x-Q. 83. Now, what kind of a stitcher did you use for spinning down the fabric?

A. Well, we used the two-inch roller from the center of the tread to possibly half way between the tread and the bead, and then I used a stitcher with about 2½ inches in diameter and a thirty-second-inch face there down to the bead.

x-Q. 84. What did you use for putting the fabric around the bead?

A. I didn't do that.

x-Q. 85. Then you stretched down and spun down the plies which went under the bead, you put on the beads (except for those that Mr. Shaw put on), and you

stretched down and spun down the remaining plies of fabric, except that you did not spin them or roll them over the beads; is that correct?

A. That's correct.

x-Q. 86. Was that finishing over the beads done in your presence?

A. It was done by a man on an adjoining machine, but I didn't watch him.

x-Q. 87. What do you mean by "an adjoining machine"?

A. Why, these were made on a stand or machine; and it's two arms projecting from it; and he finished them on the arm on the opposite side, and part of them on a similar machine alongside.

x-Q. 88. When you said "machine," you meant a making-up stand?

A. Yes, making-up stand.

x-Q. 89. Did you put the cushion-rubber on any of those tires?

A. I did not.

x-Q. 90. Did you put the breaker-strip on any?

A. I did not.

x-Q. 91. Did you put the side-wall rubber on any?

A. I did not.

x-Q. 92. Did you put the tread on any?

A. I did not.

x-Q. 93. Did you put any of them in the molds?

A. I did not.

x-Q. 94. Did you see them put in the molds?

A. I did not.

x-Q. 95. Did you see any of the rubber put on?

A. Why, I seen the man putting on the side walls and treads.

x-Q. 96. Was that done in the same room?

A. That was done at the same—by the same man that worked the plies over the bead.

x-Q. 97. Did you watch him carefully when he put on the rubber?

A. Oh, no! I just noticed he was doing it, that was all.

x-Q. 98. Do you know how long those tires were cured?

A. I do not.

x-Q. 99. And what steam-pressure or temperature?

A. I do not.

x-Q. 100. Did you do all the stretching of the fabric by yourself?

A. I did. I done all the stretching by myself. To start the first ply, some one had to hold the end or it would have slipped off of the core. That was all. Somebody held the end each time for the first ply only.

x-Q. 101. Was the core cemented?

A. Core was cemented.

x-Q. 102. Who was it held the end?

A. O, different—sometimes it was Mr. Ray, and sometimes it was Mr. Shaw; and then, if there wasn't some one right there at the second to put their hand on, I pulled the ply on, and reversed the ply afterwards and stretched that end that hadn't got stretched.

x-Q. 103. Then the first ply was not put on in the form of a continuous band? I mean it was not made in band form before it was put on?

A. It was not.

x-Q. 104. Was the core cemented?

A. It was.

x-Q. 105. How long were you an inspector at the Diamond Company before you left?

A. Exact length of time I could not tell you. It was several weeks.

x-Q. 106. What kind of tires did you make at the Diamond Company,—you yourself?

A. Myself? I made the rubber-bead clincher tire; and I made the linen-bead q. d.; and I made the wire-bead,

what we called at that time "mechanical," which is called to-day the "straight-side;" and I also made Fisk tires.

x-Q. 107. Now, on which of those did you use the hand-spinning, where you spun the core?

A. On the clinchers, q. d., and straight-sides.

x-Q. 108. The Fisk tire you referred to is that one with the big peculiar-shaped bead?

A. Yes, with bolts through it.

x-Q. 109. What size tires did you make at the Diamond Company?

A. From 28 by 3 to 5 inch or 5½; we made a few fives and a half at that time.

x-Q. 110. You made those yourself?

A. Made those myself.

x-Q. 111. What were the names of the foreman and superintendent who were over you at the Diamond Company?

A. Wheeler was the foreman; I don't remember his first name; and Mike Flynn was the superintendent.

x-Q. 112. You have spoken of a fine stitcher being used by you at the Diamond Company. What did you mean by "fine"?

A. Why, a stitcher that I afterwards described as about 2½ inches in diameter and the thirty-second-inch face.

x-Q. 113. When you said "fine" you referred to the thin edge?

A. Thin edge, yes, sir. That's the way—in mentioning the stitcher, that's the way we always mentioned it, —a "fine" stitcher.

x-Q. 114. Was there any difference between the stitcher you used at the Diamond Company and the stitcher you used in these tires you recently made in the Goodyear Company?

A. When I worked at the Diamond, I had two stitchers. The one stitcher was about an inch and a half, with

a thirty-second face; and the other one was about 2½ or 2¾, with a thirty-second face; and the larger-size stitcher was practically identical with the stitcher that I used at the Goodyear a few weeks ago.

x-Q. 115. For what did you use the stitcher of smaller diameter at the Diamond plant?

A. The stitcher of smaller diameter was the first small stitcher used in tire construction; and afterwards found that the hub of the stitcher would buckle into the plies too often, and larger stitcher was made. These larger stitchers we got at the hardware store, our own buy; we bought them ourselves.

x-Q. 116. That is, the workmen bought them themselves?

A. Yes. The factories did furnish some, but that was in the first initiating of those first stitchers; and the workmen bought a good many of them themselves.

x-Q. 117. What kind of a roll did you use at the Diamond Company for rolling the tread and adjacent portions of the fabric?

A. A roll of about inch and a half in diameter and two-inch face.

x-Q. 118. Was there any difference between that roll and the one you used for a similar purpose at the Goodyear plant?

A. There was not.

x-Q. 119. What sort of a roll did you use for rolling the beads at the Diamond plant?

A. We used a quarter-inch stitcher; inch and a half in diameter, quarter-inch face.

x-Q. 120. Like the one used at the Goodyear?

A. Like the one used at the Goodyear.

x-Q. 121. What did you use at the Diamond plant for putting the beads in position?

A. The beads in the Diamond plant were put on by

the inspector, who put them on by a line marked on the tire with a compass—compasses.

x-Q. 122. Make a little scratch?

A. Make a scratch around the tire, yes, sir.

x-Q. 123. And fit the bead to that——

A. To that mark.

x-Q. 124. Scratch line?

A. Yes, sir.

x-Q. 125. Was there any difference between the beads which you used for the straight-side tires at the Diamond plant and the beads you used at the Goodyear plant?

A. Yes.

x-Q. 126. What was the difference?

A. Well, I can't exactly explain the difference; but they were not alike.

x-Q. 127. Can't you explain at all what the difference was?

A. Well, the bead that we used at the Diamond plant was near round and was covered only with rubber, while the bead we used at the Goodyear was more of a "V" shape and was covered with fabric.

x-Q. 128. The bead you used at the Goodyear was almost triangular in cross-section, wasn't it?

A. Yes, sir.

x-Q. 129. Now, when you referred to the q. d. tires with the linen bead at the Diamond Company, you referred to what is known as the "q. d. clincher tire"?

A. "Q. d. clincher tire," "quick-detachable clinchers."

x-Q. 130. And in that the bead is quite similar in shape to the clincher bead; but it will not stretch, it is inextensible?

A. Made of linen.

x-Q. 131. That's right?

A. Yes, that's right.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 132. You say that you made 5-inch tires at the Diamond plant. Did you make 5-inch tires by the hand-spinning method or by the sawtooth method?

A. By the sawtooth method.

Rd-Q. 133. At the Diamond plant was it your custom personally to put on the rubber elements, like the cushion, tread, etc.?

A. Part of it was done by the builder, and part of it was done by a man called the "finisher".

Rd-Q. 134. And at the Diamond plant did you personally attend to putting the tire, with the rubber elements on it, in the mold, for the curing or vulcaninzing process?

A. I did not.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. SEWARD:

Rx-Q. 135. What part of the rubber elements did you put on the tire carcass at the Diamond Company?

A. The cover and side wall.

Rx-Q. 136. By the "cover" do you mean the rubber layer that goes between the carcass and the breaker-strip?

A. Yes, sir.

Rx-Q. 137. I had that in mind when I used the word "cushion" a little while ago. Did you understand me so?

A. Yes; it was called either.

Rx-Q. 138. The breaker strip is a piece of loosely woven fabric that goes around the circumference of the tire, between the cushion and the tread rubber; is that right?

A. Yes, sir.

Recross-examination closed.

Deposition closed.

Signature waived.

Certificate of Notary Public waived.

Adjourned subject to new notice or agreement.

IN THE

UNITED STATES DISTRICT COURT

DISTRICT OF NEW JERSEY.

FRANK A. SEIBERLING,
Plaintiff,

v.

THE JOHN E. THROPP'S SONS COMPANY,
Defendant.

In Equity
No. 614.

Testimony taken on behalf of the plaintiff, pursuant to notice and agreement of counsel, before WILLIAM J. DOLAN, a Notary Public, at 15 Broad Street, New York, N. Y., beginning on Wednesday, July 28, 1920.

APPEARANCES:

ROBERT FLETCHER ROGERS and LUTHER E. MORRISON, Esqs., for plaintiff; and E. CLARKSON SEWARD, Esq., for defendant.

Whereupon ARTHUR S. BROWNE, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says as follows:

Q. 1. You are the same Arthur S. Browne who has already testified in this case?

A. Yes.

Q. 2. Please state, if you know, what kinds of rubber tires were in existence prior to the automobile.

A. Prior to the introduction of the automobile, there were no tires which were capable of general use on automobiles when introduced. There were in use two types of

rubber tires. The first of these were solid rubber tires such as were used on ordinary carriages. There were also flexible pneumatic tires such as were used upon light vehicles, as bicycles and racing sulkies. These were generally known as "bicycle" tires, and being light as well as flexible, they were readily made by a number of processes.

Q. 3. Referring more particularly to the bicycle tire, what was its principal characteristic?

A. Its most conspicuous characteristic was its extreme flexibility, which rendered it incompetent for severe use. It lacked sufficient stiffness or rigidity to enable it to retain its shape by itself. It could be turned inside out or folded up in any desired way, and only when it was inflated did it retain its usable shape. It resembled a collapsible bag. I here produce two specimens of old and well-known types of pneumatic bicycle rubber tires, one of these being what is known as a "single tube" tire, and the other being the outer sheath of a double tube tire.

Plainiff's counsel introduces in evidence the tires referred to by the witness, entitled "Plaintiff's Exhibit No. 9—Bicycle Tires".

Q. 4. Next please state the general characteristics and requirements of automobile tires, such as are the subject matter of the present controversy.

A. Automobile tires must be large, stiff and massive, and no one of the usual simple processes of making bicycle tires is adequate to produce them. With automobiles, very great weights must be carried, running into tons, and as compared with bicycles, much greater speeds have to be endured, up to fifty or more miles an hour. Accordingly, they must be strong enough to sustain the enormous lateral twisting forces, such as arise in turning a corner under speed, where an accident to the tire might mean death to the occupants of the car. The automobile

tires must be able to withstand the effect of the heavy pounding oscillations of the engine which produce violent strains on the tire in one circumferential direction, and they must also be able to resist powerful braking operations which produce circumferential strains in the opposite direction. That is to say, automobile tires have to sustain severe loads and strains in ever varying combinations and in all directions. A bicycle tire is, practically speaking, not subject to these conditions. For example, in rounding a curve an automobile remains with its four wheels in contact with the ground, whereas the rider of a bicycle tilts his body and the bicycle so that the bicycle rounds the curve at a tilt, thus avoiding the lateral strain which might tend to roll the tires off the rims of the wheels. In pedalling, the rider of a bicycle constantly varies the force applied to the road conditions which he meets, and the breaking pressure required to slow down the bicycle is small on account of the relatively small speed and weight.

Q. 5. What is it which gives the necessary strength and resistance in the automobile tire?

A. It is the carcass made up of superimposed layers of strong fabric. In the completed tire this carcass is concealed, because it is covered with various layers of rubber. This rubber covering is chiefly protective in its purpose and has little capacity in resisting strains or loads. The strength giving carcass is in the nature of a corded skeleton contained beneath the surface layers of rubber and it is the element which gives strength to the tire.

Q. 6. Would you say that the automobile tire is stiff or flexible?

A. Of course it has some flexibility, but its vital characteristic is its stiffness, since it is substantially permanent in structure and shape, both when in use and when detached. It is flexible in the sense that it can

yield under strain while still transmitting the necessary power to propel the vehicle, somewhat in the same sense as a suspension bridge, but otherwise it is stiff and comparatively rigid so as to be adequate to sustain the load carried by it and to transmit the driving force. In these respects it may be likened to a leather trunk which is stiff enough to prevent injury to its contents, but can nevertheless yield under severe shocks so as not to be broken or damaged under conditions of use. But the automobile tire is not flexible in the sense that it can be turned inside out, as in the case of the open sheath of a bicycle tire.

The purpose of the automobile tire carcass is to furnish lines of strong cords in such directions as to take all loads as uniformly divided between them as practicable. In this it may be likened to the suspension bridge, wherein there is a vast number of tie wires extending in such directions and with such anchorages as to effect this result. Likewise, in the automobile tire there is a framework or carcass with a multitude of cords whose province is to divide the load equally among them.

The arrangement of the cords in layers of the automobile tire carcass is illustrated in Plaintiff's Exhibit No. 5, Fabric Shaped to Core, to which I referred in my former deposition. Each thread starts at one side of the tire from an anchorage at the lower edge or bead (that being the portion which is subsequently in contact with the wheel rim), and it runs at an angle of about 45° across the upper portion or tread of the tire, and thence angularly to an anchorage at the opposite bead. This anchoring of the cords at the two beads, and the paths of the cords in diagonal lines from one bead across the tread to the other bead, is of vital importance since the power of the engine transmitted to the wheel rims imparts motion first to the tire beads in contact with the rim

and then through the cords to the tread, which, by its contact with the ground, drives the car forward.

Not only must the cords of the fabric be laid in correct positions, but it is likewise important that the fabric should be smoothly laid. Wrinkles and uneven places are objectionable, because a wrinkle traps a certain quantity of air which expands when the tire is vulcanized, and rapid wear of the carcass at this point results. Again, the effect of a wrinkle is to divert the strain-taking cords from their proper paths, thus making them slack, and hence preventing them from usefully taking the strains.

The relation of the carcass to the wheel rim is illustrated in the sketch which I here produce, which shows a perspective view of a small portion of the wheel rim and a section of a tire carcass connected therewith, with appropriate legends to indicate the characteristic portions of the carcass.

Plaintiff's counsel introduces in evidence the sketch referred to by the witness, entitled "Plaintiff's Exhibit No. 10—Diagram of Carcass and Wheel Rim".

Q. 7. Are you familiar with the method of making tire carcasses by hand following the so-called "sawtooth method", as indicated in Plaintiff's Exhibit No. 7? If so, please describe it.

A. I am familiar with this method.

In practicing this method there is employed a revoluble ring-core or form, the surface of which has the shape in cross-section of the inside of the tire carcass. This is mounted on a swivel so that the core can be placed either in a vertical or a horizontal position. The core being placed in a vertical plane, the end of a piece of fabric from which a layer of the carcass is to be built, which has been previously made sticky by the impregnation of rubber, is secured to the core at one end, whereupon the ring-core is held fast against rotation by a detent, and

the operator forcibly pulls the fabric toward him. By a repetition of such pulls the central region or middle zone of the fabric, which is in contact with the central convex tread portion of the core, is stretched longitudinally with respect to the length of the fabric and circumferentially of the core. This action is illustrated in a picture which I here produce.

Plaintiff's counsel introduces in evidence the picture referred to by the witness, marked "Plaintiff's Exhibit No. 11—Manual Circumferential Stretching".

The workman by his successive efforts stretches the central zone of the fabric so that it extends entirely around the core until the two ends of the fabric overlap each other. As I have observed this operation, the workman frequently finds that he has not sufficiently stretched the fabric to make the ends overlap, in which event he strips a portion of the fabric from the core and exerts a stronger pull until he has sufficiently stretched the fabric so that the two ends may overlap.

The result of this hand stretching of the middle zone of the fabric is to elongate this portion of the fabric so that the tread portion of the fabric conforms in shape to the tread zone of the core. The skirts of the fabric are not only unattached to the sides of the core, but they are left in a loose and baggy condition, as indicated at the attached end of the fabric in the picture to which I have just referred, Plaintiff's Exhibit No. 11.

To finish the application of the fabric to the core in a smooth and unwrinkled condition, this looseness in the fabric must be gotten rid of during the application of the skirts of the fabric to the sides of the core.

This is accomplished by the action of the workman with a hand held tool which is either a wooden spatula commonly called a "paddle", or else a "stitcher" consist-

ing of a rotatable disk mounted in a handle. The principal and characteristic action of forming and shaping the loose skirts of the fabric to the sides of the ring-core is by the reciprocation of the paddle or stitcher by one hand of the workman in a direction which is at a small angle to the radius of the core, this reciprocation being effected for a short distance along one line and the passage by a more oblique path to another line, where this substantial radial reciprocation is repeated, the paths along which the tool is moved being indicated in Plaintiff's Exhibit No. 7. As shown in this exhibit, the paddle or stitcher travels in a serrated path which resembles in form the periphery of a circular saw, which has given the name "sawtooth" to this method.

While the workman is reciprocating the tool by one hand, he holds on to the edge of the fabric, pulling it with his other hand so as to keep the fabric taut. The consequence is that the reciprocating movement of the paddle gathers a small amount of fullness at each stroke, the tendency being to make a great number of little tucks or flat arches which are so skilfully formed that they are ironed out almost as a part of the act which produces them. In this way the workman stretches the fabric radially as he presses it against the side of the core. The radial stretching conforms the skirts of the fabric to the sides of the core in a manner analogous to that in which the circumferential stretching fits the middle portion of the fabric to the tread portion of the core.

After the workman has finished one skirt of the fabric, which he has done with the core lying horizontal, he turns the core over and applies the second skirt to the opposite side of the core in the same way. To carry out this method successfully requires skill on the part of the workman and he is able to shape the skirts of the fabric to the sides of the core because of the complete freedom of movement which can be imparted to the tool by the

practised hand of the experienced workman, who can make it do what he wants at the exact place where he is working.

If the sides of the tire are not perfectly formed by this sawtooth manipulation, so that the fabric is not completely smoothed out, or if wrinkles or blisters remain, the defects are corrected by a hand stitcher, and may even be finally rolled down by a flat cylindrical roller. Doctoring of this description is resorted to in connection with all tires, whether made by hand or by machine, although the necessity for doing this is reduced to a minimum by the machine of the State patent in suit. In the hand made tires, the amount of doctoring needed varies with the individual skill of the workman and the care and attention which he gives in making each tire.

Q. 8. Have you read the deposition of Mr. Waterman, defendant's expert?

A. Yes.

Q. 9. Will you say whether or not you agree in his statement that the machine of the State patent is non-automatic, while defendant's machine is automatic?

A. No.

Q. 10. Will you give your reasons for this answer?

A. The chief characteristics of the machine of the State patent in suit, which I discussed in my former testimony, have to do with the shaping of the skirts of the previously applied fabric onto the rapidly revolving core by means of the spinning rolls which press the fabric against the sides of the core under the action of the strong spiral springs which the State patent says are preferably employed, and during this action the support of the spinning rolls is gradually advanced radially inward with respect to the core by a screw feed. The spinning rolls are arranged at a receding angle with respect to the plane of rotation of the core so that they do not become entangled with the skirts of the fabric, which fly

outwardly under the action of the centrifugal force of the rotating core.

In defendant's machine, which I witnessed in operation, and as described in the Thropp & DeLaski patent No. 1,119,326, of December 1, 1914, the same operation is carried out by similar mechanism in a similar way.

In one respect the corresponding mechanism of defendant's machine may have an automatic action not set forth in the State patent in suit, since in defendant's machine there is provision for automatically moving the screw feed for the spinning roll support. But this automatic screw feed need not be used. The Thropp & DeLaski patent, in its description of the carriage upon which the spinning rolls are mounted, says:

> "This sliding movement of the carriage 85 is effected by a screw 86 which is threaded into a nut 87 in the carriage 85, and which screw 86 is adapted to be rotated manually by a hand wheel 88 and mechanically by miter gears 89 and 90 driven from the shaft 12 through sprockets 91 and 92, chain 93, and clutch 94."

When the spinning roll is thus manually fed by the hand of the workman, there is no difference at all between the two machines, so far as automaticity is concerned, during the shaping of the skirts of the fabric upon the rapidly revolving core by the spinning rolls.

During the spinning down of the skirts of the fabric there need be no hand manipulation of the spinning rolls in either machine. They may be left under the control of the springs in the State machine, or, in defendant's machine, under the control of the weights which the State specification says may be used instead of springs (page 5, line 121 to page 6, line 2).

Or, in either machine, the workman may by hand supplement the action of the springs or weights by himself

exerting additional pressure upon the carrying arms of the spinning rolls. Accordingly, in this respect there is no difference in automaticity between the two machines.

Q. 11. Will you compare the sequence and number of manual operations necessary in the two machines respectively, I mean more particularly with reference to forming the fabric about the sides of the core after it has been originally stretched thereon.

A. I will assume that the spinning rolls of the machine are in the position which they occupy after a layer of fabric has been completely applied to the core, so as to include the entire sequence of action, and that the machine is at rest.

In the first place, it is necessary to move the spinning rolls away from each other and from the core so that in the retraction of the carriage or support therefor, the spinning rolls will not drag upon the core or the layer of fabric thereon. This is done in the State machine by the workman pressing the spinning roll carrying arms apart and holding them apart. In defendant's machine, this is accomplished by first tightening up by hand the two set screws shown at 118 in Fig. 14 of the Thropp & de Laski patent, and as stated at page 5, line 45 thereof. Then, the hand wheel 117 is turned by hand "so that the arms 97 are spread away from the core 104 a sufficient distance to permit the arms to be advanced toward the core radially with respect thereto by means of the hand wheel 88 without engaging the periphery of the core", as stated at page 5, lines 48 to 54 of the Thropp & de Laski patent.

Then, in each machine, the spinning roll carriage is retracted by hand rotation of the feed screw until the spinning rolls are entirely out of the way of the core, so that the first layer of fabric may be stretched onto the core without interference by the spinning rolls.

Then, in each machine, after a layer of fabric has

been stretched onto the core, the workman moves the clutch to bring the high speed mechanism into action so as to rotate the core rapidly.

Then, in each machine, the spinning roll carriage is fed forward by turning the feed screw by hand until the spinning rolls are brought to the position where they are first to act to press the fabric against the sides of the core.

During this manual advance of the spinning roll carriage, the workman, with the State machine, spreads the spinning rolls apart so that they will not scrape upon the fabric, and then he releases the spinning rolls to press upon the fabric when the carriage has been advanced to the desired position for initial action.

With defendant's machine, after the carriage has been advanced to bring the spinning rolls into the initial acting position, the two set screws 118 are unloosened by hand "so as to permit the arms 97 to act under the influence of the weights 103", as stated at page 5, lines 74 and 75 of the Thropp & de Laski patent.

If the automatic feed is to be employed in the defendant's machine, the workman moves the clutch 94, as shown in Fig. 14 of the Thropp & de Laski patent, so as to bring the automatic drive of the carriage feed screws into action.

In both machines, during the spinning down action the workman may supplement the pressure of the weights or springs by manual pressure.

In defendant's machine, the workman may, if he chooses, manipulate the two handles 139, shown in Fig. 14 of the Thropp & de Laski patent, so as to change the angle of the spinning rolls with respect to the plane of rotation of the core, which is an additional hand manipulation not having any counterpart in the machine of the State patent in suit.

At the completion of the spinning down action of the spinning rolls, in both machines, the workman shifts the core rotating clutch so as to stop the rotation of the core.

This completes the cycle of manipulation.

It will be seen by this résumé that there are more hand manipulations required in defendant's machine than in the machine of the State patent in suit.

NEW YORK, July 29, 1920.

ARTHUR S. BROWNE.

Present: Parties as before.

Q. 12. Say whether or not you agree with Mr. Waterman's theory as to the mode of operation set forth in the State patent in connection with the original application of the fabric to the core, in that portion of his answer to Q. 5 in which he discusses the operation of the State machine as indicated in Fig. 12.

A. As I understand Mr. Waterman, he assumes that Fig. 12 of the State patent shows the condition after the stretching of the fabric onto the core has been completed, and on this assumption he reaches the conclusion that there is very little longitudinal stretch applied to the middle of the fabric as the result of the application of the fabric to the core. For example, after referring to the violent stretching of the fabric onto the core by the workman in the hand method of tire-making, Mr. Waterman says,

> "The section of the core and fabric, as thus applied by a stretching process comparable to hand making of tires, would not look at all like Fig. 12 of the State patent".

But, there is nothing in the State patent to suggest that Fig. 12 is intended to show the condition of the fabric either after complete application to the core as the result of the initial stretching; or, for that matter, to suggest that it shows the condition after the stretching has begun. On the contrary, a comparison between

Fig. 12 and Fig. 2 of the State patent indicates that Fig. 12 shows the condition when the workman first brings the leading edge of the fabric into contact with the periphery of the core. Fig. 2 shows the condition which exists at the beginning of the stretching operation, and as there shown the illustrated side of the leading end of the applied fabric extends down below the curved side of the core, instead of being almost as high as the rim of the core, as shown in Fig. 12.

This notion of Mr. Waterman, that the State patent only contemplates a very light circumferential stretch, is entirely without foundation in the specification of the State patent in suit.

The State patent illustrates and describes a tension mechanism to resist the rotation of each fabric supply roll, which is competent to impart any amount of longitudinal stretch which is desired. This tension mechanism is particularly illustrated in Fig. 7 of the State patent drawings and tension is repeatedly referred to in the specification,—at page 1, lines 97 to 102; page 2, beginning at line 101 and extending through to line 33 of page 3; at page 3, lines 69 to 72; and at page 6, lines 106 to 114.

I call particular attention to the passage beginning at line 101 of page 2 of the specification, from which I quote as follows:

> "The tension roll constitutes a highly important element since it secures the application of the several layers of fabric to the ring core with a uniform degree of tension."

Then, after describing in detail the tension mechanism shown in Fig. 7, the specification says,

> "If increased tension is desired on the tension-roller 36, the turn buckle 47 is manipulated so as to cause a contraction of the friction band 43 on the

disk 42 to a determined degree, indicated by the gauge 46, so that a predetermined amount of resistance will be offered to the turning or movement of the tension-roller 36."

Accordingly, the State patent contemplates a tension mechanism adequate to stretch the fabric longitudinally to any desired extent, as it is drawn from the fabric supply onto the slowly rotating ring core.

Q. 13. How does your understanding of the original application of the fabric to the ring core compare with the following statement which Mr. Waterman made in an earlier part of the same answer, where he says,

"In the condition shown in Fig. 2, the workman would engage the low speed drive to revolve the core 115 slowly, thereby drawing the fabric from the supply and *stretching it at the same time.* A tension mechanism is provided for the tension roll 36, which is seen at the left of Fig. 2 at 42, 43 and more in detail in Fig. 7 on the same sheet. The purpose of revolving the core by power is *to relieve the workmen of the physical strain of stretching the fabric, thereby getting a more uniform stretch.*" (Italics mine.)

A. This statement agrees with my understanding of the action.

Q. 14. And what about his theory, as set forth in the same answer, as to the operation of the tread roll as particularly illustrated in Fig. 12*a*?

A. As I understand Mr. Waterman, he asserts that the shaping of the fabric to the tread zone of the core to the extent indicated in Fig. 12*a* is due simply to the action of the tread roll 141.

I do not agree with this.

The tension is competent to stretch the fabric circumferentially on the tread zone of the core to the extent

indicated in Fig. 12*a*. But air bubbles may be trapped between the core and the fabric and it may not be wholly free from wrinkles. The purpose of the tread roll is to remove such air bubbles and wrinkles, and hence to shape such unformed portions of the fabric by thoroughly smoothing out the fabric at this zone.

This is what the State specification says. I quote as follows:

> "In the case of the tread-forming roll 141, this permits the operator to gradually bring the proper amount of pressure to bear on the canvas either which lies under or which actually forms the tire tread to thoroughly smooth it and shape it to the core." (Page 5, lines 54 to 60.)
>
> "It will thus be clear that after the operator has drawn a layer of rubber-coated canvas onto the ring-core, he can, by pressing the tread-forming-roll 141 against the fabric, smooth and shape the fabric on to the core and get it free of captured air bubbles or wrinkles over its outer face." (Page 5, lines 83 to 89.)

Q. 15. Referring again to these theories of Mr. Waterman as to the very lightly stretched fabric and the subsequent forming action of the tread roll, have you observed any such mode of operation in the commercial Goodyear machines which you have observed?

A. I have not.

Q. 16. I ask you the same question specifically with reference to the original State machine now in evidence, Plaintiff's Exhibit No. 2.

A. I have seen this machine in action and I have never observed any such action as Mr. Waterman talks about.

Q. 17. I next direct you to Mr. Waterman's testimony, in the same answer, to the supposed mode of operation of the State spinning rolls in forming the skirts

of the fabric to the sides of the core, and particularly as illustrated in Figs. 12*b* and 12*c*, and ask you to state whether or not you agree with him, and give your reasons.

A. As I understand Mr. Waterman, his idea is that the spinning rolls of the machine of the State patent in suit act so lightly on the skirts of the fabric that they are counteracted by the centrifugal pull of the skirts of the fabric, so that the fabric immediately in contact with the spinning rolls is not pressed against the core and is not even in contact with the core.

I understand that Mr. Waterman bases this theory upon the showing of the two diagrams 12*b* and 12*c*.

Mr. Waterman does not quote any passage of the State specification in support of his contention, and he ignores the showing of Fig. 9 of the patent drawings. In Fig. 9, the spinning rolls are shown as pressing the fabric near its edges into contact with the core, although in this illustrated position, the controlling springs are at their weakest.

Figs. 12*b* and 12*c* to which Mr. Waterman alone refers in discussing his theory, are mere illustrative diagrams to give an idea of the mode of operation, and are adequate for this purpose.

But the specification repeatedly emphasizes the fact that the spinning rolls do press the fabric into contact with the sides of the ring-core. I will quote a few passages:

> "Thereupon a pair of spinning-rolls by radial motion with respect to the ring core gradually *press* the canvas *in contact* with the sides of the ring-core toward its internal periphery to shape the sides of the tire." (P. 1, lines 57 to 61.)
>
> "The spinning-rolls 147 are preferably mounted on ball-bearings or similar anti-friction mechanism for they revolve at high speed and exert considerable *pressure* on the fabric." (P. 5, lines 93 to 97.)

"The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, *strong* spiral springs will be used. These springs exert the *pressure against* the fabric for forming it *against* the sides of the core which would be exerted by the arm of the workman in case of a hand-tool or a hand-pressed roll." (P. 5, lines 108 to 117.)

"And it is of course understood that there may be substituted for the springs and as an equivalent therefor the more cumbersome device of a weight constantly tending to force the spinning-rolls, with considerable *pressure,* toward the ring-core. When then I say the spinning-rolls or their supports are laterally spring-pressed, I mean either spring or weight *pressed* laterally *against* the ring-core for, as before stated, a spring is the equivalent of a weight." (P. 5, line 119 to p. 6, line 2.)

"In a broader aspect of my invention, however, I may employ mechanical instrumentalities, not the hands of the operator, other than springs or weights for *pressing* the spinning-rolls laterally *against* the ring-core. I shall, then, use the term 'power-pressed' to cover generally not only springs and weights but other mechanical instrumentalities for *pressing* the spinning-rolls *against* the ring-core. When I refer to my spinning-rolls as laterally yielding and no more, I mean to include any source of power for *pressing* the spinning-rolls *against* the ring-core, even the comparatively inefficient and irregular power contained in the hands of the operator." (P. 6, lines 2 to 17.) In each extract the italics are mine.

While in the majority of the claims in suit it is stated that the support for the spinning-roll is "laterally spring-pressed *toward* the core", in claim 13 it is specified that the support for the spinning-roll is "power-pressed *against* the ring-core".

It is thus unmistakable from the specification that the strong spiral springs, preferably employed, press the spinning-rolls against the intervening fabric which is thus pressed against the sides of the core and that the pressure is such as would be exerted by the arm of a workman in case of a hand-tool or hand-pressed roll.

Q. 18. Referring again to this theory of Mr. Waterman, namely, that the rolls are held in a bight of the fabric by centrifugal force and out of contact with the core, have you observed any such phenomenon in your observation of the Goodyear commercial machine, or in Plaintiff's Exhibit No. 2?

A. I have not.

Q. 19. Mr. Waterman apparently seeks to emphasize the difference between this theoretical State mode of operation and that which obtains in the use of defendant's machine. Did you observe any difference in the operation of the two forms of machine in this respect?

A. I did not.

Q. 20. Mr. Waterman says that, as distinguished from the State mode of operation, the rolls of defendant's machine "squeeze" or "pinch" the fabric against the ring-core. Do you find any use of the words "squeeze" or "pinch" in the specification of the Thropp & DeLaski patent?

A. I do not.

Q. 21. As a matter of fact, comparing the specification of the Thropp & De Laski patent with that of the State patent in suit, in which would you say this action of pressing the fabric against the side of the core is more fully described?

A. Having regard to the descriptive portions of the two specifications, and omitting the claims from consideration, there is greater emphasis in the State patent than in the Thropp & De Laski patent regarding the pressure of the spinning-rolls against the core.

Q. 22. Referring to the claims of the Thropp & De Laski patent, what do you find in connection with this?

A. There are numerous claims in the Thropp & De Laski patent which use the language "against the core" in defining how the spinning rolls are pressed or held, and there are also many claims which state that the spinning rolls or forming elements are "pressed toward the core". The Thropp claims thus use the same two expressions which are used in the claims of the State patent in suit.

There are at least thirty claims which use the expression "toward the core".

Q. 23. You have spoken of the illustration in the State patent, and particularly in Figs. 12, 12*a*, 12*b*, 12*c*, as being diagrammatic. Is illustration of this character usual in patent drawings?

A. Yes.

Q. 24. From what experience do you make that statement?

A. From thirty-eight years experience in preparing and studying patents, during the course of which I have examined tens of thousands of patents.

Q. 25. Are patent drawings supposed to be made to scale, or to be exact, or in the nature of working drawings?

A. They are not.

Q. 26. Are you able to point out similar lack of exactness in any patent you have discussed?

A. Yes,—in the Thropp & De Laski patent there is an illustration. Figs. 1 and 2 of the drawings of this patent show that the shaft 115 which carries the hand-wheel 117 is located below the arm 108 which carries one of the

slides for one of the spinning-rolls; whereas, Figs. 3 and 14 show this same shaft 115 above the arm 108. In this respect Figs. 3 and 14 are wrong and irreconcilable with Figs. 1 and 2.

Q. 27. Would you regard such a gross error as the one you have pointed out as sufficient to support an allegation of inoperativeness?

A. No. This is simply one of those common errors which are to be frequently found in patent drawings and which can deceive no person capable of understanding the patent and who really wants, from the entire document, to obtain a correct understanding of how the machine is constructed and works.

Q. 28. What would you say as to the comparative seriousness of the showing in Figs. 12*b* and 12*c* in the State patent and the discrepancy, between Figs. 1 and 2 on the one hand and Figs. 3 and 14 on the other hand, in the Thropp & De Laski patent?

A. The error in the Thropp & De Laski patent is much more serious than the showing in the State patent. There is a positively irreconcilable error in the drawings of the Thropp & De Laski patent; whereas, in the State patent the draftsman simply failed to get his lines close enough together.

Q. 29. You have testified in your previous deposition to the fact that in the demonstration of defendant's machine, which you saw, the spinning-rolls advanced at a receding angle to the plane of the core. Mr. Waterman states at various places, as for instance in his answer to Q. 62,

> "The fabric is then pressed against the core all the way to the inner edges by spinning rollers operating substantially at right angles to the surface of the core at all points and not at a receding angle", etc.

What have you to say in this respect? You may, if you like, refer to the Thropp & De Laski patent.

A. The Thropp & De Laski patent shows in Figs. 14 and 15 the position of the spinning-rolls relative to the ring-core, and in both of these figures the spinning-rolls are at a receding angle to the plane of rotation of the core, as specifically described in the State patent. Moreover, I note among the Thropp & De Laski claims that several specify that the spinning-rolls or forming elements are "arranged to engage the core at an angle to the plane thereof" (claims 12 and 13).

Even if the workman should continuously vary the angle of these spinning-rolls so as to maintain them perpendicular to tangents of the surface of the ring-core, this receding angle of the spinning-rolls to the plane of rotation of the core would continue to be present until the spinning-rolls have been moved from the position shown in Figs. 14 and 15 and they became parallel with each other.

In the exhibition of defendant's machine, which I witnessed preparatory to giving my former deposition in this case, the workman did not continuously shift the spinning-rolls so as to maintain them perpendicular to tangents of the ring-core surface, but the receding angle, substantially as shown in Figs. 14 and 15 of the Thropp & de Laski patent, was maintained until after the spinning-rolls had passed the maximum width of the core and began to move inwardly along the decreasing diameter of the core, and he then made a single shift of the spinning-rolls, as I testified in answer to x-Q. 119 in my original deposition.

Q. 30. Mr. Waterman at several points in his deposition, for instance in his answer to Q. 5, states that he understands your theory to be that the "centrifugal force acts like invisible fingers pulling the fabric radially outward thus forming a loop of the fabric adjacent to the

core", apparently believing that such action would result in a tendency to pull the forming rolls away from the core. What have you to say as to the accuracy of his assumption?

A. Either Mr. Waterman misconceives the purport of my statements, or else I failed to express myself with clearness. I had supposed that I had made my meaning so clear, particularly in the course of my answers to x-Qs. 166 to 171, that it would be impossible for anyone, even desiring to do so, to fail to understand the facts which I was endeavoring to explain.

I think I can make my explanation unmistakable by reference to Fig. 12*b* of the State patent drawings. In this particular figure, the fabric is shown as stretched to the core down to the widest thickness of the core, and the unattached skirts of the fabric are illustrated as extending outwardly in a slightly curved path averaging a perpendicular to the plane of the core. This illustrates a condition which is exhibited in the actual working of the rapidly rotating core, and the illustrated condition of the skirts of the fabric is due to centrifugal force.

The direction of the centrifugal force is, of course, radial with respect to the rotation of the core; and, if the fabric were perfectly free to adapt itself to the forces acting on it, then the unattached skirts would extend radially outward from the hinge line where they adjoin the already attached portion of the fabric.

But the fabric is not perfectly flexible, but on the contrary is relatively stiff, being a coarse duck or canvas fabric impregnated with rubber. Consequently, as a result of the centrifugal force acting upon the stiff skirts, the skirts do not stand out from the core radially, but in a curved path, this curved path varying in shape as the spinning-rolls progressively act.

Fig. 12*b* shows an intermediate stage in the laying down of the fabric.

At the outset, when the spinning-rolls begin to act, the average angle of each skirt to the plane of the core is more acute than is shown in Fig. 12*b*. That is to say, the outer edge of the skirt is farther out toward the periphery of the core, as compared with the hinge of the skirt, than is illustrated in Fig. 12*b*.

At any given moment the effect of the centrifugal force acting upon the stiff fabric is to give the appearance, as though, figuratively speaking, invisible fingers were drawing the skirts away from the core.

The practical effect is that the centrifugal force maintains the fabric smooth and wrinkle-free at the portion where the spinning-rolls act upon it to progressively force the fabric in advance of the hinge line against the surface of the core, thereby causing adhesion between the rubber impregnated fabric and the core.

The action of the centrifugal force upon the fabric does not have the effect of moving the spinning-rolls outwardly from the sides of the core so as to hold the portion of the fabric with which each spinning-roll contacts away from the side of the core.

Q. 31. Mr. Waterman, at several points in his deposition, for instance in his answer to Q. 12, says that,

> "The selection of 207 turns rather than say 200 turns or 205 turns per minute seems to indicate some special significance as though perhaps 207 might be a lower limit for the particular sort of operation discovered by the patentee."

State whether or not you find any such "special significance" in this selection.

A. I do not.

On the other hand, it is unmistakable from the language of the State patent that the particular speed of 207 revolutions per minute is given simply as an instance

of a speed which will give the desired results. What the specification says, is—

> "I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at two hundred and seven turns a minute. By this means the machine not only does more work in a given time but it does better work." (P. 2, lines 4 to 11.)

As Mr. Waterman says, in answer to Q. 72, plaintiff's exhibit No. 2, State machine, had a high speed of about 230 R.P.M. when he saw it, and this agrees with my own observation.

I note that the 207 R.P.M. mentioned in the State patent is exactly ten per cent. less than the high speed of the actual machine.

Doubless, the speed had been cut down ten per cent. at the time when the specification writer observed the machine he was describing, and the particular speed of 207 R.P.M. was given as an example which, if followed, would give the desired effects without necessitating any experimentation on the part of a person desiring to practice the invention.

Q. 32. I next direct your attention to Mr. Waterman's statement in reference to defendant's machine, as contained in Q. 66, to the effect that the core and spinning-rolls and connected parts are not constructed and coordinated for shaping and applying the previously unshaped sheeted fabric strip to that part of the core beyond the tread portion, coupled with the statement that the fabric is certainly very largely shaped by the stretching process before it is applied to the core. Do you agree with Mr. Waterman in this particular?

A. I do not.

Q. 33. Will you state whether or not this statement

of Mr. Waterman correctly describes the operation you saw when defendant's machine was demonstrated to you?

A. It does not.

As I have already testified in my former deposition, on the occasion when I witnessed the exhibition of defendant's machine, the fabric was initially stretched on the ring-core for a sufficient extent to conform to the tread zone only of the core, leaving the skirts loose and baggy. The forming or shaping of these loose, baggy skirts to the sides of the core was exclusively done during the high speed rotation of the core by the action of the forming- or spinning-rolls.

Q. 34. Will you state whether or not this statement of Mr. Waterman correctly describes the mode of operation disclosed in defendant's patent, namely, the Thropp & De Laski patent?

A. It does not. On the contrary, the Thropp & De Laski patent describes the action of defendant's machine, which I witnessed.

The rolls 132 are repeatedly referred to in the descriptive portion of the specification as "forming" rolls. I note that they are so described in at least twelve different places, namely, page 1, lines 66 and 68; page 4, lines 26, 28, 49, 51 and 125; page 5, lines 59, 76, 88 and 110; and page 7, line 18.

In describing the mode of operation first of the stretching on of the fabric around the periphery of the core and then subsequently forming and shaping the material by the forming-rolls on the sides of the core, the Thropp & De Laski specification says

> "After one layer of fabric has been thus stretched completely about the periphery of the core, it may be formed down about the sides of the core as follows:—" (P. 5, lines 43 to 47.)

Thus, it unmistakably appears that the initial stretching of the fabric is simply about the periphery of

the core; and that the shaping or forming of the fabric about the sides of the core is effected by the forming-rolls 132, which the specification then goes on to describe.

A few sentences further along, the specification says—

> "* * * the disk forming rolls 132 engage the friction fabric on each side of the core at *about the point where the fabric ceases to show its stretch due to the previous action of drawing it on the core.*" (P. 5, lines 59 to 63.) (Italics mine.)

This shows that the fabric has been initially stretched only partly on the core and that the rest of the work is done by the spinning-rolls.

Further on, the specification says—

> "As the core is rotated, the disk forming rolls will advance radially across the side thereof due to the action of the power driven screw 86, thus forming the fabric tightly about the sides of the core. * * * *After the first sheet of fabric has been thus formed completely about the core by the stretching and about the sides of the core by the disk forming rolls, a second sheet of fabric may be drawn onto the core in a manner precisely similar to that already described.*" (P. 5, lines 76 to 90.) (Italics mine.)

Further on, the specification says—

> "After this second strip has thus been stretched on the periphery of the core superposed on the first strip of fabric, it may be formed down about the sides of the core by the disk forming rolls 132 as previously described." (P. 5, lines 106 to 110.)

On the next page the specification says—

> "After the bead cores have been thus placed in position, the bead placing rings may be removed from the core and another strip or layer of friction fabric

stretched thereon and formed down about the sides of the core, as previously described." (P. 6, lines 10 to 15.)

Further on, the specification says—

"* * * the angle at which the disk rolls 132 engage the fabric on the core for forming it down about the sides thereof may be varied to a great extent." (P. 6, lines 105 to 108.)

It is thus unmistakable that the action is first to stretch the fabric around the periphery only of the core; and subsequently during the high speed rotation of the core to complete the shaping of the fabric by forming the unattached skirts down onto the sides of the core by the exclusive action of the forming-rolls.

Q. 35. Does this mode of operation, as described by you in your last two answers, in connection with the demonstration of defendant's machine and in connectio with the disclosure of defedant's patent, vary materially from the mode of action disclosed in the patent in suit and in plaintiff's commercial machine?

A. It does not. The Thropp & De Laski patent speaks about *forming* the fabric onto the sides of the core by the forming- or spinning-rolls, while the State patent refers to the same action as *shaping* the fabric onto the sides of the core by the spinning-rolls. "Forming" and "shaping" are exactly equivalent expressions in this connection.

Q. 36. Regarding this theory of Mr. Waterman as to the mode of operation in defendant's machine, what do the claims of the Thropp & De Laski patent indicate in that respect?

A. The Thropp & De Laski patent has 148 claims. In these, the rolls 132 are referred to as "elements", "devices", and "mechanism," as well as "rolls". In 145 of the 148 claims it is recited that these rolls, however

identified, are for "forming" the material on the core generally, or on the sides of the core, or, as specified in some of the claims (7, 8 and 9 among others), across the core or across the sides of the core. The remaining three claims,—50, 80 and 115,—while not using the word "forming", use an exactly equivalent expression. In each of these three claims there is specified a roll or mechanism "adapted to form the tire fabric" either "on the sides of the core and over the bead cores", as in claim 50, or "on the core and over the bead cores", as in claim 80, or "on the core both under and over the bead cores", as in claim 115.

In thirty-one of the claims the rolls are specifically recited as "forming rolls"; and in forty-three claims the rolls are specified as "forming elements".

Also, there are thirty-four of the claims which refer to the initial "stretching" of the tire material onto the core. These are claims 34 to 66 inclusive and claim 137, and in each case there is recited "means for stretching tire fabric on to the periphery of the core". In these claims the forming of the fabric onto the sides of the core is exclusively attributed to the forming-rolls.

Q. 37. Will you next compare generally the phraseology in this respect of the claims in suit with the claims of defendant's patent.

A. In each of the claims of the State patent which are involved in this suit, the function of the spinning-rolls is recited to be to pass "radially along the sides of the tire shoe to shape the sheeted fabric on the core", as in each of claims 4, 5, 6, 7, 22, 23, 24 and 25, and a similar expression is used in each of claims 12, 13 and 26. Claim 12 specifies a radially moving spinning-roll for passing "radially over the side of the tire shoe to shape the fabric on the core". Claim 13 specifies a spinning-roll mounted on the support "to pass over the side of the tire shoe to shape the fabric on the core". And claim 26 specifies a

spinning-roll passing "radially along the sides of the ring-core to curve and shape the sheeted fabric thereon".

Thus, in each claim the spinning-roll is specified as passing along the side of the tire shoe for the purpose of shaping the fabric to the core.

These claims thus define the office of the spinning-rolls in the same way as do claims of the Thropp & De Laski patent.

Q. 38. Referring next to the original State machine, Plaintiff's Exhibit No. 2, have you seen this machine in actual operation?

A. Yes.

Q. [illegible]d the machine operate satisfactorily in applying the fabric to the sides of the core?

A. It did.

Q. 40. Did it operate according to the mode of operation disclosed in the State patent in suit?

A. It did, although the speed was somewhat higher than that given as an example in the State specification.

Q. 41. Have you read Mr. Waterman's answer to Q. 17, wherein he sets forth certain alleged differences between the Goodyear commercial machine and the machine of the State patent?

A. Yes.

Q. 42. Will you kindly say whether or not you agree with him in connection with his statements concerning the lateral stretching roll of the Goodyear commercial machine.

A. In the room of the factory of the Goodyear Tire & Rubber Company, at Akron, Ohio, where, I understand, Mr. Waterman saw the State machine in operation, there are twenty-four State machines. In fourteen of these machines the stretching rolls corresponding to the rolls 36 of the State patent are cylindrical, as are also the lateral stretching rolls corresponding to the rolls 41 of

the State patent. With these machines there would be none of the supposed pre-forming. In the other ten machines, the cylindrical metal roll 36 was enveloped by a rubber cover which was slightly greater in diameter at the middle than at the ends. The "barrel shape" thus given requires critical attention to be observed when covered by the fabric. The purpose of this slight longitudinal convexing of the rolls 36 is just the same as that in the "crowning" of a belt pulley, namely, to keep the fabric running straight.

Also, in these ten machines, a portion of the lateral stretching rolls 41 is likewise similarly larger in diameter in the middle than at the ends, and for the same reason.

I carefully examined fabric which had passed over these rolls 36 and 41 and was wholly unable to detect any shaping of the fabric thereby.

Q. 43. In the same answer, Mr. Waterman condemns the quality of the work done on these Goodyear commercial machines. What have you to say in that respect?

A. My own observation of the State machine at the Goodyear factory has been that the work has been well done, and uniformly so. Of course, once in a while a layer of fabric may require hand doctoring.

I have the ordinary car-user's experience with tires and know that the Goodyear tires give satisfaction.

Also, my personal observation of the work done by the machines is corroborated by the very large number of tires which have been made upon the State machines.

Q. 44. Would you say that these Goodyear commercial machines that you have observed are built and operated in accordance with the disclosure of the State patent in suit?

A. Yes.

Q. 45. You referred in your previous deposition to the spiral path pursued by the State spinning-rolls and defendant's forming-rolls in their traverse over the sides

of the core. Are you able to produce a drawing or sketch indicating this spiral path?

A. Yes; I here produce such a sketch.

Plaintiff's counsel introduces the sketch in evidence, marked "Plaintiff's Exhibit No. 12—State's Spiral Path".

Q. 46. Have you read the translation of the Mathern Belgian patent, Defendant's Exhibit F?

A. Yes.

Q. 47. Do you note any differences in that translation from the translation you studied and discussed in Seiberling *v.* Firestone Company, with regard to the translation of the French words déplissement, déplissage, and déplisser?

A. Yes.

The Belgian patent uses the word "déplissage" three times, namely, at the last line of page 1, at line 29 of page 3, and at line 32 of page 4. It uses the word "déplisser" once, at page 2, line 28. It uses the word "déplissement" once, at page 5, line 24. In the translation made by the defendant in the Seiberling *v.* Firestone suit, the translation in each of these five instances was "unwrinkling".

In these five instances, the present translation gives "removing the puckers" twice, "removal of the puckers" once, "removal" from the fabric "of the puckers" once, and "eliminating the puckers" once.

The present translation nowhere uses the word "wrinkle" or the word "unwrinkling".

Q. 48. Mr. Waterman expresses the opinion, as for instance in his answer to Q. 32, that the Belgian patent "discloses exactly the mode of operation practised with the Goodyear machines". Do you agree with him?

A. I do not agree with Mr. Waterman. On the

contrary, there is no disclosure in the Mathern Belgian patent of the operation disclosed in the State patent.

Of course, in the light of the present knowledge of tire-making on the State machines, it would be now possible to take the machine of the Mathern Belgian patent, remove the "wrinkling" or "puckering" gears 36, or so use them as to be ineffective to perform the office which the patent sets forth; remove the side applying and cementing reciprocating rolls 30, or so employ them as to perform no useful office; stretch the fabric onto the tire so that it is only applied to the tread zone of the tire, and run the ring-core during the spinning down of the sides of the fabric at such a high speed as to maintain the fabric in an unwrinkled condition where the forming- and shaping-rolls act upon it. Should the machine be so used, then a workman sufficiently skilled to handle properly the spinning-rolls shown in Fig. 6 of the Mathern drawings could produce a usable tire carcass upon the Mathern machine.

Q. 49. Will you describe the construction and mode of operation disclosed in the Mathern Belgian patent under the translation, Defendant's Exhibit F?

A. In answering this question, I will not again describe the mechanical details of the machine which have already been described by Mr. Waterman, but I will limit myself to a consideration of the cooperating devices, which are employed in pre-forming the fabric before it reaches the ring-core; which stretch the fabric onto the core and cement its sides to the core; and the means which Mathern employs for effacing the wrinkles, puckers, or folds, however they may be denominated, after the fabric has been applied to the core.

The fabric is wound upon a supply drum or roller 18, and is regulated by an adjustable tension mechanism so that resistance is presented to the withdrawal of the fabric from the supply drum.

The middle of the fabric first passes around the rolls 26, which are shown in the drawings as spherical, but which the specification says may be "spherical or oval in form". As the specification states, this produces "a slight lengthening of the middle of the fabric, which lengthening greatly facilitates the removal of the puckers" (I use here and elsewhere in my quotations the present translation).

Alongside the rolls 26 are conical gears 36, one at each side of the fabric, and concerning them the specification says that their "sole purpose" is "to produce a slight uniform puckering of the fabric strips at their edges, ensuring in advance a uniform contraction of the fabric at all points."

The described combined effect of the rolls 26 and gears 36 is to pre-form the fabric by stretching it at its middle and gathering it at its sides.

This action is referred to in claims 2 and 8 of the Mathern patent.

Claim 2 specifies "a set of gears and of spherical rollers for producing a uniform lengthening and convexing of the fabric, thereby facilitating the sticking of it to the core".

Claim 8 specifies winding the fabric strips on the core "after a preliminary lengthening and convexing".

This pre-forming of the fabric would facilitate the subsequent sticking of it to the core, since it would be partly conformed to the shape of the core, and this is what Mathern specifies in his second claim as the purpose of this pre-formation.

The pre-formed fabric is applied to the core while the core is rotating at its slower speed. After referring to the pre-forming, the Mathern specification says,

> "Next the fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement".

The fabric is still under tension and due to this tension during its application to the ring-core, the effect would be to shape further the fabric to the periphery of the core and to cement the tread zone portion of the fabric to the periphery of the core.

While the fabric is being wound upon the core, the reciprocating rolls 30 are at work for the purpose of applying and cementing the fabric to the *sides* of the core.

The action of these rolls 30 is referred to at four places in the Mathern specification, which first says,

> "As the fabric is pulled along and unwound from the drum 18, it encounters the rollers 30 on the casing 28. This casing 28 encloses a vertical bent shaft 33, which actuates a slide 32 that is guided in the walls of the casing 28. This slide 32 carries two rods 31 at two joints. Each of these rods carries at its extremity a roller 30, which advances and retracts on the core, so as *to stick to its straight or convex sides the fabric* which has just been placed there." (Italics mine.)

The function of the rolls 30, therefore, is to stick the fabric to *the straight or convex sides of the core,* that is to say, against the sides of the core whatever the shape may be, thereby cementing the sides of the fabric to the sides of the core.

Later on, the Mathern specification also refers to

> "(*b*) of the principle of rollers 30 advancing and retracting in a radial direction while bearing on the core for *cementing the fabric on its sides.*" (Italics mine.)

Thus, as the rolls 30 reciprocate back and forth in a direction which is radial with respect to the core, they bear on the sides of the fabric, pressing it against the

core, and as the result the fabric is cemented to the core on its sides.

Again, referring to these same rolls 30, claim 3 of the Mathern Belgian specification specifies

> "a device consisting of one or more sets of rollers carried by a carriage which receives, through a bent shaft, a reciprocating movement perpendicular to the axis of the core in order to *stick the fabric on the sides of the core*". (Italics mine.)

Finally, referring to the result accomplished by these rolls, claim 8 of the Mathern patent specifies

> "(*b*) *sticking the fabric on the sides of the core*". (Italics mine.)

Thus, the middle zone of the fabric is caused to adhere to the periphery of the core as the fabric is wound onto the core, and the reciprocating rolls 30 cause the adherence of the sides or skirts of the fabric to the sides of the core.

The Mathern specification does not say anything about the speed of the ring-core during this application of the fabric to the periphery and sides of the core, but it evidently must be slow enough to permit the reciprocating rolls 30 to act effectively to apply and cement the fabric to the sides of the core.

Mathern does not illustrate or describe any power or other means for rotating the crank shaft 33 which reciprocates the side-cementing rolls 30. This shaft might be rotated by hand, in which event the winding of the fabric on the ring-core would be extremely slow in order to enable the reciprocating rolls to perform their described office.

The result of these actions up to this point is to lay and apply the fabric onto the core with wrinkles, folds, or puckers in it. Puckers, creases, or wrinkles have been

intentionally made at the sides of the fabric by the conical gears 36 and wrinkles may exist in other portions of the fabric—inevitably so, if the spherical pre-forming rolls 26 shown in the drawings are employed.

Accordingly, Mathern then proceeds to remove the puckers or wrinkles from the fabric by the employment of the tool shown in Fig. 6, or by employing two of such tools at the same time at opposite sides of the core.

These tools are loosely suspended upon two of the pins 35 projecting from the vertically fed tool carrier 17. The sole described function of these tools shown in Fig 6 is to unwrinkle the fabric or to remove the wrinkles or puckers therefrom. The action of these tools is referred to in four places in the Mathern specification, all of which I will quote. First, the specification says,

> "On the support 17, which constitutes a tool carrier, there is mounted a tool like that shown in Fig. 6, which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 *is adjusted* so that the roller comes *to the level of the top of the core.* Then the machine is set in operation and the roller is caused *to descent progressively on the side of the core and all the way down to its base.* Thus there is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34". (Italics mine.)

Thus the action of these rollers of the tools of Fig. 6, when two are employed simultaneously, is over the entire surface of the fabric, from the top of the core down to its base. Hence, wherever any puckers or wrinkles are located in the fabric, it is the intent of Mathern to remove them all by this comprehensive action of these tools.

Further on, the specification refers to the "invention" consisting, in "the manufacture of tires",

"(c) of the principle of the roller descending progressively on the core during rapid rotation and producing *a progressive removal from the fabric of the puckers* by eliminating the puckers from the point of their origin, this being performed in a single descending movement". (Italics mine.)

Thus, each pucker or wrinkle which may exist in the fabric is acted upon at the point where it begins by the roller which acts throughout the fabric as far as the pucker extends.

Claim 4 of the Mathern patent specifies

"a tool carrier having rollers and arranged to move downward automatically and progressively, dependent on the rotation of the core, in order to progressively *efface the puckers* of the successive strips of fabric". (Italics mine.)

Finally, claim 8 specifies

"(c) *eliminating the puckers formed*".

The sole office of the rollers of Fig. 6 which is mentioned in the Mathern specification is the removal or elimination of puckers or wrinkles which are present in the fabric after it has been applied and cemented to the core.

But this removal of the puckers by the tools of Fig. 6 would be intolerably slow if the ring-core were rotated at the same slow speed which is employed during the drawing of the fabric on the core and the cementing of its sides by the reciprocating rolls 30. Accordingly, Mathern provides a speed changing mechanism so that the ring-core rotates twenty and one-quarter times faster (as Mr. Waterman has figured it out) during the removal of the wrinkles or puckers.

This mode of operation is strikingly different from that of the State machine. State has no pre-forming of

his fabric, and hence has nothing like the spherical or oval rollers 26 or the gears 36 of Mathern.

State does not cement the sides of his fabric to the sides of the core during the drawing of the fabric onto the core, as Mathern does. Accordingly, State has nothing like Mathern's reciprocating side-cementing rolls 30.

Mathern intends to put puckers into the sides of his fabric by his conical gears 36 so that after the fabric has been applied and cemented to the core it has puckers in it due to the action of the gears 36, and it may have wrinkles in it too, all of which he subsequently endeavors to remove or efface by the action of the tool of his Fig. 6.

On the contrary, when State has stretched the fabric onto the core and his spinning-rolls are brought into action, the skirts of the fabric are free from the core and as the skirts are loose and baggy, in order that the spinning-rolls may act upon smooth surfaces of the fabric, the ring-core is rotated at a sufficiently high speed to spread the skirts out and away from the core by the centrifugal force developed. Then, the carriage for the spinning-rolls is fed radially inward as the spinning-rolls act upon the progressively formed hinges between the attached and unattached portions of the fabric, so that the sides of the fabric are shaped, formed and cemented to the core as the result, exclusively, of the action of the spinning-rolls during the high speed rotation of the core.

NEW YORK, July 30, 1920.

Present: Parties as before.

Q. 50. Do you know whether or not this plan of operation of Mathern, namely, the sticking of the fabric onto the core leaving wrinkles therein, and the attempt subsequently to eliminate them, was unique? If you have any authority bearing on this point please produce it.

A. It was not unique with Mathern. I make this statement on the basis of the U. S. patent of William C. Stevens, No. 1,253,105, granted January 8, 1918, on an application filed April 12, 1913. In referring to what had been done prior to his invention, Stevens says:

"Heretofore, machines have been constructed in which the tread-portion of the tire-fabric has been overstretched in order to cause the ply to conform roughly to the contour of the core and to reduce the amount of fullness or surplus in the fabric to be cared for or absorbed at the sides of the core, but in the use of these devices, in addition to the objectionable and weakening excessive stretching, wrinkles and other defects have occurred in those portions of the fabric applied to the sides of the core, dependence being placed upon a subsequent elimination of such wrinkles, either wholly or partially. The resulting detrimental effects of these defects thus occurring are not, however, completely overcome by the subsequent removal or smoothing out of the wrinkles or folds. In the operation of my improved machine, although the fabric is stretched only the required amount to maintain the finished tire-shoe or casing in normal shape and with proper strength, nevertheless, in applying the fabric to the sides of the core, no wrinkles or similar defects are permitted to form. In other words, I avoid the effects of and presence of such defects in the completed tire-casing or shoe by preventing their occurrence as the fabric is smoothed down onto the form or core, rather than placing dependence upon an attempted elimination of such faults after they have occurred."

Plaintiff's counsel introduces in evidence said patent, marked "Plaintiff's Exhibit 13—Stevens Patent".

Q. 51. What, if any, authority do you find in the Mathern Belgian patent for Mr. Waterman's assumption that the low speed of the Mathern machine may be four, six, or eight R.P.M., and the corresponding high speeds 81, 121½ and 162 R.P.M.?

A. None whatever. The Mathern specification is entirely silent on the actual speeds. The only information which the Mathern patent does give is that there are two speeds, and the high speed is twenty and one-quarter times that of the low speed, as Mr. Waterman calculates it.

If the low speed were 1 R.P.M., then the high speed would be 20¼ R.P.M. Mathern's slow speed must be such as will permit the reciprocating rolls 30 to cement the sides of the fabric to the sides of the core throughout the entire circumference of the core, and this would necessitate, I should say, a speed as low as 1 R.P.M.

Q. 52. What, if any, authority do you find for Mr. Waterman's repeated assumption that Mathern's Belgian patent is provided with spinning- or stitching-rolls?

A. None whatever.

Mr. Waterman, as I understand him, ascribes to the roller of Fig. 6 of the Mathern patent exactly the same office as is performed by the spinning-rolls of the State patent. But the spinning-rolls of the State patent act upon the centrifugally thrown out skirts of the fabric and form, shape and cement them to the sides of the core, and have no office at all of removing wrinkles or puckers in an already applied portion of the fabric. On the other hand, the Mathern specification nowhere contains any description of any shaping, forming or cementing office of the roller of his Fig. 6, the only office which he does ascribe to that roller being the removal or effacing of wrinkles or puckers.

Q. 53. What, if any, authority do you find in the Mathern Belgian specification for Mr. Waterman's as-

sumption that the patent discloses "automatic means for feeding the spinning-rolls inward radially"?

A. Mathern does have an automatically fed tool carrier 17 with laterally projecting pins 35 upon which the tool of Fig. 6 can be suspended. But, as Mr. Waterman himself says, in answer to Q. 31—

> "The spinning rollers arranged as shown in Fig. 6 are very cleverly devised so that they merely hook over journal pins 35. They are guided and pressed to the work by the hand of the workman applied to handles thereon as clearly appears in Fig. 6. It results from this mode of mounting not only that they are readily applied and removed, but that if they encounter an obstacle while being positively fed downward, they simply lift from their pivots. Thus if they should happen to come down on top of the core, they would lift instead of jamming and breaking something. Similarly if they should run against the bead after it had been applied, they would lift instead of forcing the bead out of place."

It is hence evident that by reason of its open hook embracing a pin 35, the tool of Fig. 6 is neither automatically nor positively fed downward.

For example, if the workman who has hold of the tool handle keeps the tool in a definite vertical position, the tool carrier slide will feed downwardly without imparting any feed at all to the tool and would ultimately feed down far enough to remove entirely the lateral pin 35 from the open hook of the tool. The workman himself must perform the act of feeding the tool downward. The only function of the slide 17 and its pin 35 with respect to the feed of the tool is that it prevents the workman feeding the tool down too fast. The tool cannot slip in the hands of the workman and go down too far. But the progressive and gradual radial advance of the tool, while

limited by the tool carrier, is due solely to the conscious act of the workman. The workman, therefore, must feed the tool ahead at the same time that he is pressing its roller against the fabric, and is preventing the tool from being tilted in the plane of the core's rotation.

Q. 54. Mr. Waterman refers to the slide which carries the pair of rolls 30 as reciprocated "a short distance" back and forth. What, if any, authority do you find for this statement?

A. None whatever.

The specification of the Mathern patent refers to the bent or crank shaft 33 as the instrumentality for reciprocating the rolls 30, and the Mathern drawings show a sufficient crank throw to give a long reciprocation to the rolls 30 relatively to the sides of the core.

Perhaps Mr. Waterman's idea is that the rolls 30 can be reciprocated only to the extent of the length of the guide slot for their carrying bar 31, which is shown in Fig. 1 of the Mathern drawings. The length of this slot is less than the throw of the crank shaft 33. Accordingly, if this slot does limit the reciprocation of the rolls, then the shaft 33 would have to be rocked back and forth, involving a slower operation and hence slower rotation of the ring-core than if the crank shaft would be continuously rotated. I note, in this connection, that in "Defendant's Exhibit H—Machine of Mathern Belgian Patent", the crank shaft is rotated around and around and there is no limitation of the reciprocation of the rolls by the guide slots. Assuming, therefore, that in this respect Defendant's Exhibit H is a correct representation of the Mathern Belgian patent, then the crank throw shown in the Belgian patent is ample to reciprocate the rolls 30 throughout the entire width of the sides of the core. Thus, they are competent to perform the office ascribed to them in the Mathern specification.

Q. 55. Referring to the tool of Fig. 6, Mr. Waterman

says "that it is impossible for these rollers to act on the tread portion as they would simply be lifted off from their supports"; and again, that they "therefore act on the side of the core where the fabric has not been previously formed by stretching". What, if any, authority do you find in the Mathern Belgian specification for these statements?

A. None whatever.

On the contrary, the Mathern specification, as I have already quoted, says—

> "The sliding tool carrier 17 is adjusted so that the roller comes *to the level of the top of the core.* Then the machine is set in operation and the roller is caused to descend progressively *on the side of the core and all the way down to its base*". (Italics mine.)

The workman can maintain the roller of Fig. 6 in operative contact with any portion of the fabric at any portion of the core, even though the feed slide carriage does feed ahead, since the maintenance of the hooks of the tool in any definite vertical position with relation to the corresponding pins 35 on the slide 17 depends on the workman himself.

Q. 56. Mr. Waterman, in answer to Q. 31, in describing the supposed mode of operation of the Mathern Belgian machine, says:

> "He then by means of the hand wheel adjusts the position of the slide 17 so as to bring the spinning roll of Fig. 6 about to the level of the top of the core. He then starts the machine and assumes the position for holding the handle of the spinning tools, there being two of these, one for each side of the core. By the time he has assumed this working position and is ready to apply pressure, after having started the machine, the spinning rolls will have

reached the proper level to begin action and the operator presses them heavily against the core thereby pinching the fabric between the spinning rolls and the core and spinning it smoothly into shape simultaneously applying it to the cemented surface of the core."

What, if any, authority do you find in the Mathern Belgian specification for this assumption?

A. None whatever. There is no suggestion in the patent that any interval intervenes after the machine is set in operation and while the workman is doing something else to enable a sufficient feed of the tool carrying slide 17 to bring the rollers of Fig. 6 down to "the proper level to begin action". What the Mathern specification says is—

"The sliding tool carrier 17 *is adjusted* so that the roller comes *to the level of the top of the core.* Then the machine is set in operation and *the roller is caused to descend* progressively *on the side of the core and all the way down to its base*". (Italics mine.)

One act immediately follows the other.

There is no suggestion of an idle interval during the rotation of the core.

Furthermore, your quotation from Mr. Waterman contains the statement that as the roll of Fig. 6 travels downward it spins the fabric "smoothly into shape simultaneously applying it to the cemented surface of the core." There is nothing of this sort described in the Mathern patent. There is no reference to any spinning-down action of the roll of Fig. 6; no suggestion that such roll has any office whatever in applying any portion of the fabric to the cemented surface of the core; and no suggestion that any shaping of the fabric to the core is performed by that roll. On the contrary, the only office

473

which the Mathern specification ascribes to the tool of Fig. 6 is to remove or efface puckers or wrinkles already in the fabric.

Q. 57. I call attention to the following statement of Mr. Waterman in his answer to Q. 31:

> "Thus I find from this comparison that the Mathern machine supplies all of the tire making instrumentalities furnished by the State machine, but whereas the State machine is a mere aggregation of the tools, the Mathern machine has automatic feeding means making it in a real sense an automatic machine, as distinguished from an assemblage of tools."

What, if any, authority do you find in the Mathern Belgian specification for this statement?

A. The machine of the Mathern patent does not automatically feed the tool of Fig. 6, for reasons I have already stated. All that the radially movable tool carriage 17 does when the tool of Fig. 6 is employed, is to prevent the workman feeding the tool too fast.

Q. 58. I call your attention to the following statement of Mr. Waterman referring to the conical gears 36:

> "These gears are not described as having any important or essential function but are merely auxiliary refinements".

What, if any, authority do you find in the Mathern Belgian patent for this statement?

A. None whatever. It would be just as accurate to say that any other feature of the machine was an auxiliary refinement. The Mathern specification places as much stress upon these gears as upon any other part of his machine, and they or their office are referred to in two of the claims.

Q. 59. Mr. Waterman, in answer to Q. 31, says that,

in describing the gears 36, the Belgian specification states that there are "a pair of such conical gears on each side". What, if any, authority do you find for this statement?

A. None whatever.

The Belgian patent merely shows and describes one conical gear for each side of the fabric. Nowhere does the Belgian specification mention "a pair" of gears on "each side".

Mr. Waterman does not point out any such language in the Belgian specification, and the showing of the Belgian drawings is unmistakable. Fig. 1 shows a side view of the machine. It illustrates the two spherical rolls 26 and a single conical gear 36 with its axis midway between the axes of the rolls 26. The illustrated support for the rolls and gear in Fig. 1 would be wholly incompetent to support a second gear alongside the gear shown. The specification refers specifically to these gears in two places. After referring to the rolls, it says

> "On the same support there is mounted at each side two conical gears 36".

If this statement stood by itself it would be ambiguous, because it might mean either that there were two gears at each side, or that there were two gears altogether, one at each side. But this sentence must be taken in connection with the drawings which are being described and to which the reference numeral 36 refers, and when this sentence of the specification is read, looking at the drawings, the ambiguity disappears and it is unmistakable that there are but two gears, one at each side.

But the specification leaves the matter beyond possibility of misinterpretation, even by one wishing to misunderstand, since further on, it says:—

> "The control systems of the several mechanisms may differ from those described above, but the invention comprises the application in the manufacture

of tires (*a*) of the principle of *two* rollers 26 and *two* side gears, which prepare the fabric". (Italics mine.)

In other words, there are just as many gears 36 as there are rollers 26, and the statement of number here made corresponds exactly with the drawings showing them, *two* (not four) rollers 26, and *two* (not four) gears 36.

Q. 60. I also refer you to Mr. Waterman's statement (Q. 69) that the machine of the Belgian patent operates "satisfactorily with the action of the rollers 30 omitted, the fabric being properly stretched on the core". What, if any, authority do you find in the Mathern Belgian specification for a statement of this character?

A. There is no suggestion in the Mathern Belgian specification that the rolls 30 can be omitted.

Q. 61. I call your attention to the following statement of Mr. Waterman (Q. 32), referring to the Belgian patent and the Goodyear machine,

> "Thus in both the fabric is stretched into partial conformation with the core and the tread portion rolled into intimate contact therewith".

What, if any, authority do you find in the Mathern Belgian specification for this statement?

A. None whatever.

Mr. Waterman is here apparently referring to the action of the tread roller 141 shown in the State patent. The State commercial machine also has a tread roller which acts upon the tread zone of the fabric on the core. Mathern describes nothing of the sort. Mathern's rolls 30 do not act upon the tread portion of the fabric, but are solely described as acting upon the sides of the fabric and the sides of the core.

Q. 62. Referring to the translation of the Mathern

Belgian specification, and more particularly to the following sentence thereof

> "The fabric, on leaving the drum, passes between two rolls that are spherical or oval in form and arranged in such a manner as to produce a slight lengthening of the middle of the fabric, which lengthening greatly facilitates the removal of the puckers."

I will ask you to state what you understand by the particular words, " which lengthening greatly facilitates the removal of the puckers".

A. The lengthening referred to is that which is due to the stretching of the fabric at its middle by the action of the rolls 26, so that the fabric is laid onto the core in a partially formed condition. Consequently, there is less danger of the fabric wrinkling in the immediate vicinity of the periphery of the rim of the core than would be the case if there were no longitudinal stretch. For example, to take an extreme case, assume that the fabric should be wound around the core without any longitudinal stretch at all. In that event all portions of the fabric except along the median peripheral line of the core would be loose and baggy. Then, if the fabric should be simply laid down upon the sides of the core, it would be full of wrinkles all starting at the median peripheral line. Such wrinkles would be removed with difficulty.

Therefore, any longitudinal stretch of the fabric, either before or as it is applied to the periphery of the core, reduces the liability of the formation of wrinkles, minimizing the size of such wrinkles as are formed, and hence the elimination of wrinkles as are formed is facilitated by the lengthwise stretch.

As I understand Mr. Waterman, the only "puckers" which are to be removed are those which are due to the action of the conical gears 26. From his view, as I understand it, there was nothing else in the nature of a wrinkle

elsewhere in the fabric to be removed or effaced after application of the fabric to the core.

But, this is wholly inconsistent with the passage of the specification under consideration. At the very time that Mathern is stretching the fabric along the middle by the rolls 26 to facilitate the removal of "puckers" he is trying to put "puckers" into the edges of the fabric by means of the bevel gears 36. This stretching of the fabric at the middle, therefore, can have nothing to do with the subsequent removal of such puckers as may be formed by the conical gears. Therefore, the "puckers" whose removal is facilitated by the longitudinal stretching of the middle of the fabric are those which occur or may be formed in the body of the fabric, as distinguished from that portion of the sides of the fabric upon which the conical gears act.

Since, therefore, under the mode of operation set forth in the Mathern patent, the wrinkles or puckers may exist at any part of the fabric, Mathern starts the action of his unwrinkling or unpuckering tool at the top of the core, as the specification particularly says is the case.

I note, in this connection, that the translation produced by defendant in the Firestone case at this point in the specification construes the expression "*allongement facilitant de beaucoup le déplissage*" as "elongation greatly facilitating the *unwrinkling*". This accords with the action which does take place.

I also note that Professor Spiers also testified that the word "déplissage" is more properly to be translated as "unwrinkling".

Q. 63. If I understand you correctly, the Mathern Belgian specification describes the use and purpose of the conical gears 36 as to form puckers at or near the edges of the fabric in order to contract or convex it approximately to the shape of the core. What have you to say in this connection as to Mr. Waterman's assumption that

the tool of Fig. 6 is to be used on the fabric in conjunction with the core when the latter is rotating at high speed, approximately that of the State commercial machine?

A. Mathern's pre-contraction of the edge portions of the fabric by the intended initial performance of the conical gears 36 is wholly inconsistent with the subsequent employment of the ring-core rotating at anything approximating the commercial speed of the State machine, namely, at about 125 R.P.M. Should any such speed be employed, the unattached skirts of the fabric would fly outwardly away from the core under centrifugal force, thus destroying the effect intended by the puckering of the fabric along its edges. It would be wholly senseless first to pre-shape the fabric to the approximate shape of the core, and then immediately after destroy the shape which pains had been taken to secure.

Q. 64. What do you know about the subsequent history of the Mathern Belgian patent?

A. I am familiar with the taking out of Belgian patents and the steps necessary to keep them alive. Under the Belgian law at the time of the grant of the Mathern patent, the life of Belgian patents was subject to the payment of annuities. Any annuity could be paid within one month after the anniversary of the patent. An annuity fell due on the Mathern Belgian patent in 1907 and was payable on or before October 20, 1907. This first annuity amounted to twenty francs, less than four dollars. Also, under the Belgian law, at any time within five months thereafter the annuity could have been paid with an additional fine of ten francs. The final period for paying the annuity and the fine expired on March 20, 1908.

The data effecting incidents regarding Belgian patents are published in the official publication "Moniteur Belge". This publication, in the issue of August 9, 1908, shows that the first annuity of twenty francs was

not paid and that the Belgian patent lapsed on its first anniversary.

Plaintiff's counsel introduces in evidence a certified copy of the portion of the "Moniteur Belge" referred to, marked "Plaintiff's Exhibit No. 14—Moniteur Belge".

Q. 65. I will ask you to examine the Mathern German patent, "Ausgegeben den 26. Januar 1909", Defendant's Exhibit O, and say whether or not you agree with Mr. Waterman's statement to the effect that this patent "shows a machine which in all of its major features is substantially the same as that which I have already described in considering the Belgian patent".

A. I do not agree with Mr. Waterman.

I will not describe this patent in detail because I am advised by counsel that it is not of a sufficiently early date to be a part of the prior art affecting the State patent in suit.

I will simply call attention to the conspicuous differences between this German patent and the Mathern Belgian patent, which are as follows:

1. The Belgian patent illustrates and describes two of the conical gears 36. The German patent shows and describes *four* of these gears, two at each side of the spherical rolls 26. Fig. 4 of the German patent illustrates this arrangement of gears and there is no figure in the Belgian patent drawings corresponding to it. The single conical gear 36 for each margin of the fabric, as shown and described in the Belgian patent, was probably incompetent to effect the desired contraction, whereas, a pair of gears at each side, as shown in the German patent, could doubtless be made to pucker the fabric and cause its circumferential contraction.

2. The German patent omits altogether any tool like that of Fig. 6 of the Belgian patent, having no correspond-

ing figure in the drawings and saying nothing about such a tool in the specification.

3. The German patent introduces an altogether new feature, namely, an oscillating sector or cradle carrying a series of stepped rollers 38. This sector or cradle 29 is oscillated back and forth in an arc concentric with the axis of rotation of the ring-core so that each of the several stepped rollers always acts on the fabric at a definite distance from the axis of rotation of the ring-core. No one of these stepped rollers has any radial movement with respect to the plane of the ring-core and accordingly no one of these stepped rollers has any action or movement similar to that of the roller of Fig. 6 of the Mathern Belgian patent.

4. In the described operation of the machine of the Mathern Belgian patent, the ring-core makes several (probably many) rotations during the unwrinkling or pucker-removing action of the tool of Fig. 6. On the contrary, in the German patent the ring-core (although then rotating at its higher speed) makes but a single complete revolution during the action of the stepped rollers 38.

The German patent retains the reciprocating side rollers 30 and the spherical or oval rolls 26.

Q. 66. If I understand Mr. Waterman correctly, he treats the gears 36 and the rolls 30 of the Belgian patent as of small importance, and regards the tool of Fig. 6 as Mathern's principal operative instrumentality. Is this assumption of Mr. Waterman supported by the German patent?

A. On the contrary, the German patent has the exact reverse effect.

In answer to Q. 31, Mr. Waterman says that the conical gears of the Belgian patent "are not described as having any important or essential function but are merely auxiliary refinements". The German patent, however,

not only retains these gears, but renders them efficient by the improvement of having two conical gears for each side of the fabric.

In answer to Q. 69, regarding the action of the machine of the Belgian patent, Mr. Waterman says that "the machine operated satisfactorily with the action of the rollers 30 omitted, the fabric being properly stretched on the core". Mathern, however, did not omit the rolls 30 when he came to take out his German patent, but retained them.

On the other hand, the tool of Fig. 6 of the Belgian patent, to which Mr. Waterman ascribes the offices of shaping, forming, applying and cementing the sides of the fabric to the core, Mathern discarded altogether when he came to take out his German patent.

Q. 67. Have you examined the French patent to Hernandez, Defendant's Exhibit P, which was granted January 8, 1909, and published March 19, 1909?

A. Yes. However, I consider it unnecessary to discuss this patent because I am advised by counsel that because of its date this French patent does not constitute a part of the prior art in respect to the State patent in suit.

Q. 68. Have you examined the U. S. Patent to Vincent, No. 794,473, Defendant's Exhibit J, and have you read Mr. Waterman's testimony in connection therewith?

A. Yes.

Q. 69. Will you state whether or not you agree with Mr. Waterman's conclusions as to this Vincent patent?

A. Yes, with one possible exception. In referring to the hammers 30 of this patent, Mr. Waterman in answer to Q. 43 says,

> "These hammers act progressively radially inward as the core with the fabric applied to it rotates thus laying the fabric smoothly against the core with a progressive inward radial action."

If this simply means that the different hammers are arranged at different distances from the axis of rotation of the core, then I agree with Mr. Waterman.

If, however, he means that each hammer has an inward radial movement so that the hammers collectively have a progressively inward radial action, then I do not agree with him, because no one of the hammers has any radial component of movement, and accordingly each hammer is incompetent to have any radial stretching action upon the fabric.

Q. 70. How about the effects on the fabric of any centrifugal force in this Vincent machine?

A. The ring-core of the Vincent machine is rotated slowly at all times by the illustrated worm drive. There is, therefore, present no such rotation as would cause the fabric to fly stiffly outward away from the core. Moreover, the hammers would prevent any such flying out of the fabric because they extend all the way over the sides of the fabric.

Q. 71. In describing this Vincent machine, Mr. Waterman (Q. 43) says that "it stretches the fabric so nearly to the final shape that spinning rolls are not necessary". And again, that "the canvas thus goes on the core already stretched substantially in shape". What is the effect on the fabric of the stretching thus described?

A. The effect is to leave the margins of the fabric substantially unstretched so that the reticulations thereof when applied to the core would be in their original square condition. In all other parts of the fabric from the margin of the fabric up to the top of the core, the reticulations would be of diamond shape with the long axis of the diamond extending circumferentially and increasing in length gradually from the margin of the fabric up to the top of the core, where the elongation of the diamonds circumferentially would be most pronounced.

This would involve excessive stretch on the middle of

the fabric with consequent danger of weakening it at the tread zone.

Q. 72. Does this method of forming the fabric to approximately its final shape by circumferential stretch alone resemble the mode of operation embodied in the State patent in suit and in defendant's machine?

A. It does not. Both in the machine of the State patent in suit and in defendant's machine, the tread zone of the fabric is shaped by circumferential stretching and the sides of the fabric are formed by radial stretching due to the action of the spinnning-rolls.

Q. 73. Have you read the U. S. patent to Seiberling & Stevens, No. 762,561, Defendant's Exhibit K, and Mr. Waterman's testimony in regard thereto?

A. Yes.

Q. 74. Please state whether or not you agree with his conclusions.

A. I agree with Mr. Waterman, except in the following matters:—

Mr. Waterman refers to the creasing rolls 91 shown in Fig. 4 of the Seiberling & Stevens machine as "radially acting stitching rollers" and as "radially movable with respect" to the sides of the tire. These rollers 91 are "sharp edged", as stated at line 118, page 3 of the specification, and their sole function is to crease the fabric at its margin, as stated in the specification as follows:

> "After passing this smoothing device the fabric must then be tucked into a crease which exists near the lower end of the core and forced there with considerable pressure to cause it to adhere until it is desired to remove the finished shell from the core. This creasing of the fabric in the manufacture of tires is known to the trade as 'stitching'." (P. 3, lines 98 to 106.)

This sharp edged creasing and stitching roll 91 cannot have any radial action because of the mounting shown in Fig. 4. If the handle is moved upwardly from the position shown in Fig. 4, the first effect is to spread the creasing rolls 91 apart from each other so as to free them from contact with the fabric on the core. Then, further lifting of the handle swings the carrying arm 89 upwardly on its pivot 88, during which movement the left-hand creasing roll rises twice as fast as does the right-hand creasing roll, by reason of the different distances from said pivot where they are respectively carried by said support 89. Accordingly, these creasing rolls do not move radially and could not possibly act to stretch the fabric radially as is done by the spinning-rolls of the State patent in suit. Moreover, these creasing rolls have sharp edges which would preclude their employment as shaping-rolls to shape the sides of the fabric to the core, since they would injure the fabric if so employed.

Also, at the close of his answer to Q. 44, Mr. Waterman says that these creasing rolls "act on the inner portions of the fabric after the tread roll has acted thereon". Literally this is true, in that the action of the tread roll in smoothing the periphery of the fabric upon the tread zone in the fabric does occur at a stage preceding the action of the creasing rolls. But between these two actions the reciprocating jigger fingers 85 have performed their office and the sides of the fabric have thus been shaped to the sides of the core. Also, it is here to be noted that the tread roll 17 constitutes the driver for the ring-core and the tread roll is performing its driving office while the creasing rolls are tucking the fabric into the crease.

In this same answer, referring to the Seiberling & Stevens machine, Mr. Waterman says, "Thus, the machine may, like the State machine, have a high and low speed drive". There is no statement in the Seiberling & Stevens

patent that there is any change in speed of the ring-core after stretching the fabric onto the core and before the reciprocating jigger fingers 85 are brought into action. There is no statement in the Seiberling & Stevens patent that any such speed of the ring-core is ever obtained as would result in pulling out the skirts of the fabric stiffly by centrifugal force.

Q. 75. Which mode of operation do you find embodied in this Seiberling & Stevens machine,—that which relies upon circumferential stretch alone for the formation of the fabric, or the one which relies partly on circumferential stretch and partly on radial stretch?

NEW YORK, July 31, 1920.

Present: Parties as before.

A. The latter. Circumferential stretch is obtained when drawing the fabric onto the ring-core. Radial stretch on the skirts of the fabric is achieved by the reciprocating action of the jigger fingers 85.

Q. 76. Have you read the U. S. patent to Moore, No. 518,112, Defendant's Exhibit L, and Mr. Waterman's testimony in respect thereto?

A. Yes.

Q. 77. Will you state whether or not you agree with his conclusions?

A. I do not agree with Mr. Waterman. The machine of the Moore patent and the way it is used are so totally unlike the State machine and the way it is used, and Mr. Waterman gives such an inadequate explanation of the Moore machine, that I can best explain wherein I differ from Mr. Waterman by giving a description of the way in which the Moore machine is used.

This patent is dated April 10, 1894, at which time automobiles were unknown in the United States, and the

stated object of the invention is "to provide a machine on which the shoes or covers of the pneumatic tires used on the wheels of bicycles &c., may be conveniently and expeditiously manufactured". (P. 1, lines 11-15.)

Moore has "a shell constituted by a ring of sheet metal which is severed or split at one point" (P. 2, line 95), which is shown in Figs. 3, 4 and 5, and the outer periphery of this expansible shell is shaped to conform to that of the fabric which is placed upon it. The fabric, which Moore calls the "lining", is first woven into the desired shape conforming to the contour of the exterior of the expansible shell. (P. 2, lines 104-110). This fabric is illustrated in Fig. 7.

Moore's procedure is as follows:

1. The shell is contracted and is placed upon the expanding form illustrated in Figs. 1 and 2. (P. 2, line 125.)

2. "A piece of lining fabric or material having been made into the form of an endless ring by means of cement or sewing is then put on the shell." (P. 3, lines 2-5.)

3. The expanding mechanism is then actuated so as to expand the shell to the position shown in Fig. 3, the effect of which is "to stretch tightly the endless ring of lining material or fabric which has been applied to the said shell." (P. 2, lines 52-55.) This is done as the expander is rotated.

4. "While the parts continue to rotate, the cement is applied to the surface of the lining material or fabric and distributed uniformly by means of the roll 701, a suitable scraping knife being first applied, if desired." (P. 3, lines 86-90.) The cement distributing roll 701 is shown at the left in Fig. 1. This roll "has cylindrical portions for working upon the raised portions of the lining and a narrow raised portion for entering the depressions or angles". (P. 3, lines 93-96.)

5. "If desired a non-extensible twine or yarn, or suitable wire may now be wound on the lining at each side of the middle portion." (P. 3, lines 96-99.) I understand by this that a twine or wire is to be placed around the tire in each crease between one of the wings 53 and the adjoining body part 531.

6. "Then the shell is removed and placed in a dry room to partly dry the lining and thereby create the desired adhesive condition of the cement." (P. 3, lines 99-102.)

7. The specification then goes on to describe how the shell may be removed without contracting it. The specification further on says "The shell, which remains of the full size to which it was expanded, is now removed and taken away from the expansible former, and is set aside in the dry room until the rubber has set (*sic*) upon the lining fabric or material". (P. 4, lines 7-12.)

8. The shell is then again applied to the expansible former. The specification says "The second time it is thus applied, which is after the cement has set as above noted, the wings of the lining are turned down onto the intermediate or middle portion to form the tread". (P. 4, lines 19-23.) By this I understand that the wings 53 are folded over upon the central body portion 531 (see Fig. 7) thus enclosing the embedded circumferential wires or twines.

9. The rolls 47 and 48 shown in Fig. 1 are then "successively brought into action, smoothing and stretching the said wings into proper position and condition, the narrow roller working into the angles of the shell." (P. 4, lines 24-28.) 48, is the "narrow roller".

10. "Then the pneumatic roller 44 is brought into action to even up the lining and expel air from between the layers." (P. 4, lines 28-30.) This pneumatic roller 44 is shown in Fig. 1.

11. "Another coating of cement is applied to the surface". (P. 4, lines 30 and 31.)

12. "and the shell is removed and again placed in the dry room to allow such coating to set". (P. 4, lines 32 and 33.)

13. "After the said coating has set, the shell is for the third time placed on the expansible former"

14. "for the purpose of having the rubber covering put on, the latter being composed usually of sheet rubber" (P. 4, lines 34-38.)

15. "The pneumatic roller is used on the rubber covering to expel air and work the same into proper place and position". (P. 4, lines 38-40.)

Regarding the entire operation, the specification says

> "It is not intended to remove the lining fabric or lining from the shell after having been applied thereto, until the same is finished and thoroughly set". (P. 4, lines 40-44.)

It seems to me it suffices to recite what Moore does to show that the machine bears no resemblance in any respect to the machine of the patent in suit.

Q. 78. Have you read the Jeffery patent No. 607,245, Defendant's Exhibit M, and Mr. Waterman's testimony in connection therewith?

A. I have.

Q. 79. Will you say whether or not you agree with Mr. Waterman's conclusions?

A. I do not agree with Mr. Waterman's conclusions. Jeffery has a wheel the rim of which has two circumferential grooves, shown in Fig. 1 of the drawings. Jeffery says

> "Upon this wheel I wrap a strap, or as many straps as may be desired, of fabric suitable for the tire-sheath, using, as is customary for such purpose,

preferably a fabric which is saturated or charged to a suitable degree with rubber gum, rendering it adhesive, so that it adheres both to itself and to the wheel". (P. 1, lines 60-67.)

The action of his machine is to force the overlying portions of the fabric into the circumferential grooves by means of either the tool shown in Fig. 3 or the double tool shown in Fig. 2. Concerning this action, the specification says

"C is a wheel or roller having a dull knife-edged periphery adapting it to force the fabric into the groove when it is pressed against the outer surface of the fabric as the latter lies over the grooves while the wheel A revolves. The wheel C may be mounted in a handle to be held by the operator while pressing the wheel into the grooves, as in Fig. 3, or there may be two such wheels mounted on a common hub C' or roller provided with two beads, amounting to the same thing, carried in bearings D D, movable with respect to the forming-wheel A, so that both wheels may be simultaneously pressed up against the wheel A as the latter revolves and the fabric stretched into both grooves at once. There is some advantage in thus working on both grooves at the same time, because thereby the fabric is drawn both ways from the middle at once and is not stretched out of position, as it might be if one line only were operated at a time." (P. 2, lines 35-56.)

This bears no resemblance to the State mode of procedure.

Whatever may be the speed of rotation of Jeffery's wheel, the fabric maintains the same relation to it. There can be no throwing out of unattached skirts of the fabric, as in the State machine.

Jeffery's tools simply force the fabric into the grooves on the periphery of the wheel.

Jeffery's tools do not stretch the fabric radially against the sides of a ring-core, as do the spinning-rolls of the State patent.

Jeffery's patent application was filed Jan. 12, 1894, before automobiles were in use.

Q. 80. Have you read U. S. Letters Patent to Bayne & Subers, No. 847,041, Defendant's Exhibit X, and Mr. Waterman's testimony with respect thereto?

A. Yes.

Q. 81. Will you state whether or not you agree with Mr. Waterman's conclusions.

A. I do not.

This Bayne & Subers patent is for a method of tire manufacture which is totally different from that of the State patent in suit.

State starts with a flat woven fabric and shapes this flat fabric to the core.

Bayne and Subers do not use a fabric at all. The Bayne & Subers patent handles threads or cords and winds the same upon the ring-core.

For this purpose Bayne & Subers utilizes three sets of grooved wheels which are called "director wheels", over which the "prepared insulated threads" are designed to run, first with the director wheels 19 in the position shown in Fig. 4 of the drawings, namely at the base of the core. As shown in this figure, there are two threads *a* each of which is led to one of the grooved director wheels 19. As the core rotates these director wheels lay the two cores around its circumference. The support 28 for each director wheel is fed radially upward by the screw feed illustrated in Fig. 4. Accordingly, the director wheels lay the two cords in spiral paths on the sides of the core.

These two director wheels handle the two threads until they reach the position indicated at 21 in Fig. 4 of the

drawings and as described at lines 35 to 40 of page 2 of the specification. The two threads are then transferred from the director wheels 19 to the two director wheels 36 respectively. These director wheels 36 are referred to as "crown" director wheels, the wheels 19 being referred to as "side winding" director wheels. Concerning this transfer of the threads from the grooved wheels 19 to the grooved wheels 36, the specification says:

> "The highest path of each side-winding director wheel and the lowest path of each crown director wheel come so closely together that the thread will almost run from one to the other. However, the thread is placed in position in the proper guide when the exact position of transfer is attained and the machine is not necessarily stopped to permit this transfer if run slowly." (P. 3, lines 12-20.)

Hence, either a slow rotation of the core is required or else it must be stopped to enable this transfer to be made.

The crown director wheels 36 then handle the two threads and as these crown wheels are arranged to move toward each other, they wind the two threads spirally upon the crown or tread zone of the core.

Also, two additional grooved director wheels 50 are employed, as shown in Fig. 6, for the purpose of laying the two additional threads spirally around the horizontally extending lateral extensions E (see Fig. 4) of the core or "frame" as it is called in the specification. This action of the two director wheels 50 is described at lines 39 to 51 of page 3 of the specification.

This is obviously a totally different mode of operation from that of the State patent in suit.

At the close of his answer to Q. 51, in discussing this Bayne & Subers patent, Mr. Waterman says

"Indeed, there is no apparent reason why by simply rotating the machine in the *opposite* direction so that the wheels 19 would progress radially from without inwards (instead of in the reverse direction as when laying on the cords) the machine would not radially spin the fabric of a fabric tire smoothly down against the core."

That is to say, by acting upon a fabric instead of upon the cords; by rotating the core in the opposite direction to that which Bayne & Subers actually employ; by rotating the core fast enough to cause the fabric to fly out by centrifugal force; and by changing the contour of the grooved director wheels so as to have rounded convex edges, as in the State patent; Mr. Waterman with his present knowledge of the State machine can convert the Bayne & Subers machine into a State machine.

Q. 82. Have you read the three U. S. Letters Patent relating to metal spinning, Dewey 438,407, Defendant's Exhibit Q; Seymour 80,836, Defendant's Exhibit R; and Seymour, 376,167, Defendant's Exhibit S; and also Mr. Waterman's testimony in respect thereto?

A. Yes.

Q. 83. Will you say whether or not you agree with Mr. Waterman's conclusions.

A. I do not.

Mr. Waterman starts his answer to Q. 57 with a statement with which I agree. Referring to the spinning down of the fabric as carried out in the State patent and there referred to as "spinning", Mr. Waterman says

"It is of course an entirely different use of the word 'spinning' to that in which it is employed in textile work as referring to the forming of yarns".

Equally so, the use of the word "spinning" in the State patent is entirely different from its use when de-

scribing the spinning of metals, or the spinning of boys' tops.

In all four instances, namely the spinning of yarn, the spinning of metal, the spinning of a top, or the spinning of the State patent, there is the common employment of high speed in the rotating spinning device. It is from this high speed that the word "spinning" in each instance is derived.

In metal spinning, the metal is made to flow. That is to say, the metal is displaced from one position to another. The metal cannot be changed greatly in shape except at several stages between which the metal has to be heated or else the metal has to be maintained hot.

There is nothing in metal spinning which bears any analogy whatsoever to the shaping of flat fabric to a curved surface by a stretching of the fabric so as to change the shape of the reticulations of the thread.

The Dewey patent 438,407, October 14, 1890, is a fair example of metal spinning: Dewey starts out by saying:

> "Articles have been manufactured from sheet metal heretofore by successive and graduated pressing, depending on the depth of the article, and in some cases the metal was annealed after each pressing, as such pressing operation rapidly hardened it, which in turn caused the metal to tear and crack. Some metals, as German silver, are too brittle to be pressed to a great extent by this method. The process depends for its success upon the malleability of the metal; and it is the purpose of my invention to keep the metal annealed or in a softened condition during a greater part of if not the entire or complete formation of the article and to decrease the number of molds as well as the number of pressings usually required in forming or shaping the article, and also to save time in handling". (P. 1, 17-35.)

As he here states, he is enabled to greatly change the shape of a sheet of metal because he maintains the metal in a softened condition by heat during the greater part of if not the entirely complete formation of the article, thereby decreasing the number of different moulds which have to be employed.

As shown in Fig. 2 of his drawings, the sheet of metal *a* is clamped between the rotary mold C and the face plate *a'* of a revolving spindle. The metal thus clamped and rotated is maintained hot by the electrical heater indicated at E.

Accordingly, by thus maintaining the metal in a soft condition by heating it he is able to make it conform to the shape of the mold in one continuous operation, and thereby avoids the several stages theretofore employed with intermediate heat treatments.

Regarding this Dewey patent, Mr. Waterman says

> "As the spinning tool moves over the core the metal is shaped to the latter but the centrifugal force holds the unspun portion standing straight out."

In spite of the fact that the metal is softened by the heat it is still stiff enough to stand out by itself. The centrifugal force present has no possible contribution to the effect. Perhaps Mr. Waterman imagines that the metal is in a semi-fluid condition, which it would have to be in order that the centrifugal force could cause it to assume any different position from that due to its own inherent stiffness, and should this be the proper inference to be derived from the Dewey patent, the Dewey method is vitally distinct from that of the State, because State does not subject his fabric to any such temperature as would be required to render metal semi-fluid.

The two Seymour patents to which Mr. Waterman refers, show the prior sort of spinning to which the Dewey patent refers. That is to say, in these prior patents only

a limited amount of shaping of the metal can be produced at any one stage.

Take the Seymour patent 80,836, Aug. 11, 1868, as an example. In this case, the metal is first shaped by the conical former shown in Fig. 6, concerning which the specification says

> "Figure 6 is an elevation of a conical former, that may be used for giving shape to the article to be made in its first stages".

That is to say, by several stages the metal is shaped to fit the former of Fig. 6; finally, the shape is to be changed from that shown in Fig. 6 to that indicated by the former shown in Fig. 1. The conical shaped article is clamped between the rotating former of Fig. 1 and the rotatable chuck or "whirl" *h'*, and the final shape is then given by the tool *t*.

The remaining patent, that of Seymour 376,167, Jan. 10, 1888, says

> "In this way air-chambers for pumps and other apparatus may be produced of thin steel or copper of great tensile strength and finely finished. The machine may also be employed for the purpose of contracting a number of cylindric shells one upon another, in order to make therefrom a piece of ordnance or cannon, each cylindric shell forming a mandrel upon which the next outer cylindric shell is tightly and permanently contracted". (P. 1, lines 22-32.)

As shown in Fig. 1, Seymour starts with a previously formed cylindrical shell D with a hemispherical end. The hemispherical end is clamped between the rotary mandrel B and the chuck C'. The cylindrical shell is not shaped upon an interior core but has to be bent

inwardly to the position indicated by the dotted lines in Fig. 1.

Regarding the operation, the specification says

> "The cylinder or cylindric shell D may be brought to the form shown by full lines in Fig. 1, preparatory to operating upon it by this machine, by drawing with suitable dies and mandrels, and either in a heated or cold state, or in both a heated and cold state, the first drawing or folding operations being performed while the metal is heated, and the subsequent drawing operations being performed while the metal is in a cold state. The cylindric shell D may be operated upon by my improved machine either in a hot or cold state." (P. 3, lines 29-40.)

This adequately shows that a number of different stages of action are required to get the metal article into final shape, just as the subsequent Dewey patent says was the case prior to his invention.

This shaping of metal bears no resemblance to the forming of a flat fabric upon a ring-core, first by longitudinally stretching and then by radial stretching.

Q. 84. Have you read Mr. Waterman's testimony in connection with the speed mechanism of the machine of the State patent, and particularly with reference to the spiral gearing, etc. therein discussed?

A. Yes.

Q. 85. Will you say whether or not you agree with Mr. Waterman in his conclusions and make such comment thereon as you deem necessary.

A. I do not agree with Mr. Waterman.

The State patent makes the perfectly explicit statement that when the ring-core is moving slowly it has say six revolutions a minute, and that during the action of the spinning-rolls it operates at a much higher speed,

say at two hundred seven turns a minute, or approximately thirty-five times as great (p. 2, lines 2 to 9).

It also illustrates and describes the "speed changing mechanism", and as I pointed out in my former deposition, in order to get the desired difference of speed any mechanic would know that all that it was necessary to do was to have the proper speed ratio between the driving worm shafts and the spiral gears which are rotated therefrom, and I pointed out that this gear arrangement would be simply a matter of providing the gears with an appropriate number of teeth, which any mechanic would know how to supply.

The State patent is entirely adequate to direct any mechanic who wants to get the particular difference in speed ratio which State specifies.

Mr. Waterman appears to base his difficulty in understanding the State patent upon three points.

First, he points out the discrepancy in the use of the reference numerals at page 4, lines 2 and 4, and at lines 79 and 80 of the same page. Of course the scrivener has made a mistake in one of these two places, but it causes no confusion to anyone trying intelligently to read the patent. Mr. Waterman himself has pointed out that if lines 79 and 80 are followed an impossible organization is produced. If lines 2 and 4 are correct a rational organization is disclosed competent to secure the specified speed ratio.

Mr. Waterman also calls attention to the circumstance that in the sections of the two gears 75 and 83 shown in Fig. 3, each shows a single tooth in elevation; whereas, a true section of the gears shown in plan view in Fig. 1, would show at least one tooth in cross-section. It is evident that the draftsman has made a conventional showing in Fig. 3. No Patent Office drawings are expected to show gear teeth accurately. Even the tooth of a plain spur gear is difficult to draw, as the working sur-

face of the tooth is commonly the involute of a circle, which requires great care to draw. Spiral teeth are still more difficult to draw. As all the characteristics of gear teeth are old and well known, it is customary in Patent Office drawings to show them conventionally.

Finally, through the use of the words "just as" at line 127 of page 3, Mr. Waterman concludes that the two gears 75 and 83 are identical, and that the two worms for driving them are identical, so that the speed difference would be simply that due to the different diameters of the sprocket wheels 79 and 82 (shown in Fig. 3), and thus Mr. Waterman reaches the conclusion that the speed ratio is approximately three to two instead of about thirty-five to one, which the patent specifically uses as an illustration.

On the basis of this interpretation of the words "just as", Mr. Waterman goes on elaborately to show how absurd results would follow.

I will again quote the sentence containing the words "just as". It is as follows:

> "The clutch member 72 is provided with a hub 74 rigidly secured to a spiral gear 75 adapted to be driven by a worm 76 mounted on the shaft 58 *just as* the corresponding clutch member 73 has a hub 84 secured to a spiral pinion 83 driven by a worm 82 from a spiral shaft 78." (P. 3, lines 123 to 129.)

The rational meaning of the language quoted is that the spiral gear 75 and worm 76 are "mounted" in the same way as the spiral pinion 83 and the worm 82. This is a true statement of the organization. There is no statement that the two spiral pinions 75 and 83 are identical or that the two worms 76 and 82 are identical. It is unmistakable that they are not to be identical because the two gears 75 and 83 are to be driven at different speeds in the ratio of 207 to 6, that is, about thirty-four and a

half to one. There is nothing in this language to compel the resulting absurdities which Mr. Waterman brings about by assuming that the comparison involved in the words "just as" means identity in all respects. Anyone understanding what State is trying to do would know that this is not the case.

Any mechanic examining Fig. 4 would see that the worm 76 therein shown drives the spiral gear 75 there shown at a much slower rate, in the ratio of about one to forty-five.

Then, looking at the relation between sprockets 79 and 82 in Fig. 3, he would see that the shaft 78 is driven more slowly than the shaft 58, in a ratio in the neighborhood of three to two,—more accurately nineteen to fourteen, and consequently when the shaft 58 is rotated forty-five times, the shaft 78 would rotate a trifle over thirty-three times at the 19 to 14 ratio. The patent does not show a figure like Fig. 4 to indicate the worm which drives the spiral gear 83, but the mechanic knows that 83 must be driven so as to go 34.5 times as fast as the spiral gear 75. Now, as the shaft 78 rotates slightly over thirty-three times to one rotation of the slow spiral gear 75, the gear ratio between the worm on the shaft 78 and the high speed spiral gear 83 would have to be in the ratio of 34.5 to 33+ in order that the spiral gear 83 may rotate 34.5 times to 33+ rotations of the shaft 78, and to one rotation of the spiral gear 75. It is merely necessary to select such a worm gear on the shaft 78 as will drive the spiral gear 83 at this ratio. If the worm has twenty-four teeth and the gear 83 has twenty-three teeth, the specified ratio will be obtained. The patent is adequate for a mechanic familiar with gearing to get the desired speed ratio.

Problems of gearing, for the purpose of getting different speeds, were so well known that it was not necessary for State to do more than indicate what he desires

to get in order to enable the skilled mechanic to make the necessary calculations and provide the proper gears.

Q. 86. Does it make any difference on which sides the high and low speed mechanisms respectively are arranged?

A. It does not make any difference, so far as the operation is concerned, whether the high speed drive is nearer the core or farther from the core than the low speed drive. As a matter of convenient assemblage of the machine, it is doubtless more convenient to put the high speed drive away from the core, as in the Plaintiff's Exhibit No. 2.

Direct-examination closed.

NEW YORK, N. Y., August 3, 1920.

Present: Parties as before.

CROSS-EXAMINATION BY MR. SEWARD:

By consent of counsel, the following objections are made now with the same force as if made at the same time that the questions and answers objected to were asked and given.

Mr. Seward: I object to Qs. and As. 16 and 18, which refer to Plaintiff's Exhibit No. 2, and also to Qs. and As. 38, 39 and 40, which also refer to the same exhibit, because plaintiff's counsel has declined to give a demonstration of the operation of the said exhibit for the purpose of testimony from my expert; and I give notice that I shall move the Court for an order requiring such a demonstration for the purpose of my testimony and shall object to any demonstration of the said exhibit at the time of final argument, or on appeal, either or both.

Counsel for plaintiff states that the sole reason for not exhibiting the machine in operation was the inability to obtain the proper power in the temporary loft where it was located in Barclay Street. Numerous efforts were made to get the proper electric power, but it was impossible within the period under discussion. Then, due to the scarcity of available space in the City of New York, it was subsequently removed to a storage warehouse where it still stands. If the Court deems it desirable or necessary to have it operated, this will be attended to at some convenient time and place. The character of the machine renders it extremely difficult to handle and operate, its weight amounting to in the neighborhood of six tons. A considerable part of the difficulty involved at the temporary place of exhibition was whether or not the floors were strong enough to sustain it. When it was finally set up, an additional and temporary platform had to be made for it so as the distribute the weight over a space greater than the normal floor space.

Mr. Seward: I am ready to attend with my expert at any reasonable time and place for the purpose of a demonstration of the said machine, be it in New York or any other city, said demonstration to be for the purpose of enabling my expert to give testimony with respect thereto; and I again request such a demonstration.

Counsel for plaintiff states that it is not his intention to operate the machine either for the purpose of exhibition, and probably not even at the time the matter is presented to the Court. Defendant's counsel and expert have been afforded opportunity to witness the operation of the commercial Goodyear machines, and the differences betwen those machines and the first machine are trifling, and such

differences have been already pointed out and expounded by plaintiff's expert. In addition, the tremendous inconvenience and expense involved in procuring quarters and the necessary power and means to place the machine in operation seem to be out of all proportion to the trifling advantage of satisfying the curiosity of defendant's expert in the matter.

Mr. Seward: I object to the answer to Q. 50, which refers to the Stevens patent, No. 1,253,105, and to the offer in evidence of the said patent, on the ground that the same are immaterial, incompetent and irrelevant, and move to strike the same from the record.

x-Q. 87. When do you say automobiles were first known in this country?

A. Of course, it depends on whether is meant such knowledge as may be derived from publications or such knowledge as is derived from the commercial use of such machines, that is to say, the use of such machines in the regular course of commercial sale and their employment in the ordinary course of business or pleasure.

Historically, as a matter of publications available in the United States, the history of self-propelled vehicles for general road use, as distinguished from self-propelled vehicles running on tracks, goes back to about 1830.

Then, there were sporadic early instances of steam-propelled cars in the United States as early as 1895, or possibly a year or two earlier. From such steam cars were developed the early steam cars that were made by the Locomobile Company, the Stanley Brothers, and the White Company.

But it was certainly subsequent to 1895 that automobiles came into sufficient use in the United States as to be regarded as articles of commerce or trade, or as

even an occasionally witnessed object on public roads. Indeed, in 1898 and 1899 cars operated by gasoline engines were more or less of a curiosity.

x-Q. 88. By the first sentence of your answer to Q. 4, do you mean to say that the patented art did not show apparatus for and methods of making tires similar to the closed mold and hand method which was used largely in making automobile tires, I mean the patented art as early as 1893?

A. I do not at present recall any patents or publications as early as 1893 illustrating such method of manufacture. Certainly there was no such patent in evidence which has been called to my attention.

x-Q. 89. The bicycle tires to which you refer were made of woven fabric body and rubber, were they not?

A. Yes.

x-Q. 90. Some of them were open on the inner periphery and had clincher edges?

A. Yes.

x-Q. 91. And these last named were designed to be used over an inner inflatable tube?

A. Yes.

x-Q. 92. And this form of bicycle tire was known in the early nineties, was it not?

A. I should say from recollection about the latter part of 1892.

x-Q. 93. Do you know what the shape of the reticulations of the fabric body in those bicycle tires was when then were inflated for use?

A. As a matter of observation or examination, I would say no. Any internal pressure, however, on a pneumatic tire having a woven fabric in its composition would have a tendency at least to cause some re-arrangement of the reticulations, producing some lozenge or diamond shapes.

x-Q. 94. Would the tendency be that these lozenges

at the outer part of the tire would have their long axes circumferentially disposed and those near the inner part of the tire radially?

A. Yes.

x-Q. 95. About how many times have you seen what you have described as the "hand operation" of making automobile tires?

A. I went on three occasions to the factory of the Goodyear Tire & Rubber Company, for the purpose of witnessing the hand operation. The first occasion was prior to the final hearing of the Firestone suit. The second time was prior to giving my first deposition in the present case. The third time was about a month ago.

x-Q. 96. Did you see tires made by hand on the third occasion?

A. Yes.

x-Q.97. About how many tires have you seen made by this hand operation?

A. It would be very difficult to state; a good many.

x-Q. 98. Have you seen over fifty?

A. I should say so; yes.

x-Q. 99. Watching the complete operation?

A. Yes.

x-Q. 100. On each occasion did you watch one man, I mean the same man, making tires by hand?

A. No, I saw several men on each occasion.

x-Q. 101. And you probably saw over fifteen tires completely made on each occasion?

A. I should say so; yes.

x-Q. 102. Was this regular factory operation or were they made by hand for the purpose of demonstration to you?

A. Of course, I cannot tell whether it was regular factory operation or a demonstration. I should gather it was regular factory operation.

x-Q. 103. Were these tires made of woven fabric or were they cord tires?

A. Both. Even the cord tires made by the Goodyear Company are made from a woven fabric.

x-Q. 104. In that fabric, the weft threads are very light, are they not, and spaced far apart simply for the purpose of holding the warp threads in alignment?

A. Yes.

x-Q. 105. The warp threads constitute the strength of the fabric?

A. Yes.

x-Q. 106. Now, can you say about what percentage of those tires you saw made by hand were cord and what percentage were ordinary woven canvas or duck?

A. I made no attempt to discriminate, so that it would be very difficult for me to estimate. I should say from recollection that I saw more of the cord tires made than the fabric tires.

x-Q. 107. For how long a time, about, did you observe this operation on each of the said visits?

A. Several hours all together, I should say.

x-Q. 108. You mean several hours on each occasion?

A. No; all together.

x-Q. 109. That is, several hours for the three occasions put together?

A. Yes.

x-Q. 110. Perhaps five or six hours?

A. No, I should not say that; perhaps two or three hours.

x-Q. 111. About how many times did you observe that the workman found that he had not sufficiently stretched the fabric to make the ends overlap, so that he stripped a portion of the fabric from the core and exerted a stronger pull until he had sufficiently stretched it so that the two ends would overlap?

A. Nearly every time.

x-Q. 112. Did that occur in both the cord and ordinary woven fabric tires?

A. Yes.

x-Q. 113. In your answer to Q. 10, you mention the strong spiral springs of the machine of the State patent employed for pressing the spinning-rolls laterally towards the core. Do you consider those a characteristic feature of the State machine?

A. Yes.

x-Q. 114. In your answer to Q. 17, you refer to Figs. 12*b*, 12*c* and 9 of the State patent in suit. Do you intend to use the disclosure of Fig. 9 to correct the showings of Figs. 12*b* and 12*c*?

A. No, because I think that Figs. 12*b* and 12*c* do not require any correction.

x-Q. 115. Now, 12*c* shows the edges of the fabric turned out around the edges of the spinning-rolls. That is so, is it not?

A. Yes.

x-Q. 116. While Fig. 9 shows the edges of the fabric lying down against the tongue of the core, and not turned out around the edges of the spinning-rolls?

A. Yes.

x-Q. 117. Which of these figures do you say is correct, in that respect?

A. Both.

x-Q. 118. Why is that?

A. In some conditions the fabric may assume one position and in other conditions it may assume the other.

x-Q. 119. Would it assume the condition shown in Fig. 9 during the inward motion of the spinning-rolls or at the end of their inward motion; by "inward motion" I refer to the inward radial motion?

A. Yes, particularly if the fabric is a little stiff.

x-Q. 120. I believe it is a fact that you testified as an expert in the case of the Republic Rubber Company

against Morgan & Wright, which case was in the Second Circuit, and involved the patent on the so-called "staggered tread" non-skid tire. Is that so?

A. I testified in a couple of suits on that patent. I have forgotten the name of the defendant in either case. I know one case was in the Second Circuit.

x-Q. 121. In your answer to Q. 26, you refer to the DeLaski & Thropp patent, No. 1,129,326, December 1, 1914, which has been put in evidence by plaintiff, and particularly to Figs. 1, 2, 3 and 14 thereof. With reference to Figs. 3 and 14, if the lines embodied in the shaft 115 had been dotted instead of solid where they cross the arm 108, the showing of Figs. 3 and 14 in this respect would be consistent with the showings of Figs. 1 and 2. Is that a fact?

A. Yes.

x-Q. 122. Do you say that there is a mistake in Figs. 12*b* and 12*c*, or either one, of the State patent in suit?

A. Yes, provided that it is to be supposed that these figures are anything more than diagrams to indicate the mode of operation. For example, Fig. 12c does not even show the spinning-rolls in contact with the fabric, being illustrated with a clear space between. If this figure is to be treated hypercritically, then this is a mistake.

Likewise, Fig. 12*b* does not show the fabric acted upon by the rolls as being pressed against the sides of the core, and if this figure is supposed to show actual operative conditions, there is a mistake in this respect.

x-Q. 123. Are there any other mistakes in Figs. 12*b* and 12*c* that you can point out?

A. As compared with the other figures, there may be others. I do not note any.

x-Q. 124. Fig. 12*c* does not show the fabric pressed against the core by the spinning-rolls, does it?

A. No. As I have said, it does not show the spinning-rolls even in contact with the fabric.

x-Q. 125. You have not seen the defendant's machine operated since you gave your *prima facie* testimony, have you?

A. I have not seen the exhibit defendant's machine operated since I gave my former testimony. But since then I have been retained in a suit for the Lee Tire & Rubber Company and have been at their factory on two or three occasions, and I have noted quite a number of the defendant's machines in use at that factory. I saw a dozen, or maybe sixteen.

x-Q. 126. Did you make any tests or examinations of the operation of those machines?

A. I saw them doing the regular work of the factory but made nothing in the way of tests.

x-Q. 127. Did you make detailed or particular examinations of their work?

A. Only enough to see that the machines were in substantial accordance with the exhibit defendant's machine and that good tires were produced. Also, I noted some tires being made by hand there.

x-Q. 128. About how long did you watch hand-making?

A. Just casually in going by.

x-Q. 129. When you observed the operation of the exhibit defendant's machine, to which you have referred, did the initial stretching operation of the fabric, I mean the circumferential stretching, shape and form the fabric to the outer curvature of the core? By the "outer curvature" I refer to the part which you have referred to as the "tread zone".

A. Yes.

x-Q. 130. Did this stretching and forming take place before any operation of the spinning-rolls?

A. Yes.

x-Q. 131. In the operation of the machine of the State patent, do you say that the spinning-rolls serve to remove

wrinkles or puckers which existed in the fabric unattached to the core prior to the starting of the operation of the spinning rolls?

A. No.

x-Q. 132. Then, do you say that after the fabric has been stretched on the core circumferentially and the tread roller employed, in the operation of the machine of the State patent, there are no wrinkles or puckers in the unapplied portions of the fabric?

A. No.

x-Q. 133. What is the fact?

A. The fact is that after the fabric has been stretched circumferentially on the core and the tread roller has been used, the skirts of the fabric are in a loose and baggy condition. Indeed, I do not quarrel with the use of the word "puckers" as indicating a condition of that kind. The effect of the centrifugal force is to throw out the fabric away from the core and to leave that portion of the fabric, at least which the spinning-rolls act against, in a smooth condition. Consequently, the circumstance that ultimately the fabric is laid against the core without wrinkles or puckers in it is due to the combined effect of the centrifugal force and the action of the spinning-rolls. There is no laying of the fabric in a wrinkled condition against the sides of the core to produce wrinkles requiring to be eliminated by the action of the spinning-rolls upon the wrinkled surface of the fabric.

x-Q. 134. But, prior to the step of operating the spinning-rolls in conjunction with the high speed rotation of the core, there are puckers or corrugations in the unattached portions of the fabric which do not exist after the step of operating the spinning-rolls has been completed?

A. Yes.

x-Q. 135. I hand you a sketch and will ask you whether

or not you say that well shows the limit of inward motion of the rolls 30 of the Mathern Belgian patent.

A. Yes, this sketch is an enlarged reproduction of what the drawing of the Mathern Belgian patent actually shows.

x-Q. 136. Well, does this sketch well show the limit of inward motion of the rolls 30?

A. Yes, as the same is disclosed in the Mathern Belgian patent.

x-Q. 137. Do you recognize this sketch made by plaintiff's witness, Mr. Ray, and referred to in yours and Mr. Ray's affidavits in the case of Seiberling *v.* Firestone, which you have mentioned?

A. Yes.

Mr. Seward: I offer this sketch in evidence, and ask that it be marked "Defendant's Exhibit Z".

x-Q. 138. Do I understand it is your contention that the tool of Figure 6 of the Mathern Belgian patent operates on the entire outer surface of the fabric on the core?

A. Yes.

x-Q. 139. From the center of the tread down to the end of the base of the fabric on both sides?

A. Yes.

x-Q. 140. But the Mathern specification says that the roll descends progressively on the side of the core, does it not?

A. Yes, from the top.

x-Q. 141. Where does it say that, "from the top"?

A. I have quoted the passage in my answer to Q. 56. I have there said that the slide is adjusted to bring the rollers to the level of the top of the core, and from this they act all the way down the sides of the core to the base.

x-Q. 142. And the passage to which you refer is the

one which is quoted in your answer to Q. 56? You do not now refer to any other passage of the patent?

A. No.

x-Q. 143. If only a single conical gear is used at each side of the oval or spherical rolls in the Mathern Belgian patent, will there be any puckering or plaiting of the edges of the fabric?

A. I should think it would be quite inefficient to produce any puckering or plaiting of the fabric. I have never seen such an organization used and so can only speak from general considerations.

x-Q. 144. But is it your opinion that a single such gear so placed on each side would perform any puckering or plaiting of the fabric?

A. I doubt very much if it would perform any puckering or plaiting of the fabric.

x-Q. 145. Then I understand you to say that the Mathern Belgian patent shows and describes the employment of only one such gear at each side?

A. Yes.

x-Q. 146. Do you say that the rolls 30 of the Mathern Belgian patent and the rolls 39 of the Mathern German patent perform the same function?

A. Yes.

x-Q. 147. In the operation of the machine of the State patent, does the circumferential stretching of the fabric on the core so as to cause it to conform about to what you have called the "tread zone" render it easier to remove the fullness, puckers, or corrugations in the edges of the fabric by the action of the spinning-rolls, than if a much less circumferential stretch were employed?

A. Yes.

x-Q. 148. And this circumferential stretch might be so increased as to leave very little work for the spinning-rolls to do?

A. Yes.

x-Q. 149. Would you say that your answers to the last two questions would also apply to the Exhibit Defendant's Machine?

A. Yes.

x-Q. 150. Do you understand from the Mathern Belgian patent that the core is intended to be rotated at such a high speed as to cause the edges of the fabric to fly out under the influence of centrifugal force during the operation of the cradle 29 and rollers 38?

A. No.

x-Q. 151. Do you say that the machine of the State patent in suit operates according to what you have described as its characteristic mode of operation, whether or not the tread roller is employed?

A. Yes.

x-Q. 152. In your answer to Q. 66 you call attention to Mr. Waterman's assertion that the machine of the Mathern Belgian patent operated satisfactorily with the action of the rollers 30 omitted, the fabric being properly stretched on the core. And you mention that Mathern, however, did not omit the rolls 30 when he came to take out his German patent?

A. Yes.

x-Q. 153. It is also true that he did not omit them when he came to take out his Belgian patent?

A. Yes.

x-Q. 154. And it is also true that State did not omit his tread roll when he took out his patent in suit?

A. Yes.

x-Q. 155. Nor did he omit it when he took out his British patent which is in evidence?

A. He did not.

x-Q. 156. Do you find anything in the State patent in suit which refers to any radial stretching of the fabric?

A. I do not recall any place in the State patent which refers to radial stretching.

x-Q. 157. Why do you say, in your answer to Q. 70, that the ring-core of the Vincent machine is rotated slowly at all times by the illustrated worm drive?

A. There are several reasons that influenced my statement. In the first place, there is no change speed mechanism in the Vincent patent. The ring-core when rotated at all is rotated by the driving worm 6, shown in Fig. 1, which engages a worm wheel 7, shown best in Figs. 2 and 3, which is on the shaft carrying the ring-core. The illustrated worm gearing would impart a relatively slow movement to the ring-core. During this rotation of the ring-core the fabric is drawn from the supply over the stretching rolls 16 and 17, and this would imply a slow speed drive.

Also, during this same rotation of the ring-core the hammers 30 act. These hammers are moved away from the core and the fabric thereon by the cams shown in Fig. 2, and when the cams release these hammers they are thrown against the fabric on the core by springs and are thus brought into contact with the fabric until again lifted off by the cams. This involves a period of contact between the hammers and the fabric which would be inconsistent with any high speed of the ring-core.

And hence, for all of these reasons I assume that the ring-core rotates slowly.

x-Q. 158. The patent says that the hammers rise immediately after striking the canvas, does it not?

A. Yes. But this language is to be taken into consideration in connection with the operative conditions. With the illustrated mechanism, and particularly with the second or third layers of fabric, the hammers would remain in contact with the fabric under spring pressure for an appreciable length of time.

x-Q. 159. In your answer to Q. 71, you discuss the circumferential stretching of the fabric by the Vincent patent so as to be almost entirely conformed to the core,

and you refer to it as "excessive stretch". Do you mean to be understood that such a method is not employed on a large scale for the production of satisfactory commercial tires?

A. I do not know anything about the extent of use of such a method.

x-Q. 160. Do you know whether or not such a method is commercially used?

A. I do not.

x-Q. 161. Did you make any tests to ascertain whether or not there is radial stretching of the fabric in the operation of the Exhibit Defendant's Machine?

A. I shall have to refer you to my former deposition.

x-Q. 162. You mean your *prima facie* deposition in this case?

A. Yes. I have no independent recollection at the present time.

x-Q. 163. In the operation of the spinning-rolls in the machine of the State patent, is the fabric displaced from one position to another?

A. Yes.

x-Q. 164. In your answer to Q. 86 you say, referring to the machine of the State patent in suit, "It is doubtless more convenient to put the high speed drive away from the core". Why is it more convenient?

A. It is more convenient to get the driving connections to the source of power.

x-Q. 165. And this arrangement which you have referred to as existing in Plaintiff's Exhibit No. 2, is the opposite of the arrangement which you say exists in the State patent in suit?

A. Yes.

x-Q. 166. Do you say that the method of operation of the machine of the State patent in suit, which you have several times referred to as "State's mode of operation"

or other words to that effect, is inherent in the machine of the State patent as described?

A. Yes.

x-Q. 167. Do you say that mode of operation is the necessary result of operating the machine of the State patent as described?

A. Yes.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 168. You have referred to having seen, on your several visits to the Goodyear factory, a number of tires, perhaps forty or fifty, made by hand. Will you kindly state more fully how many men were engaged in the work that you witnessed.

A. I should say there must have been fifteen or twenty men that I saw doing work.

Rd-Q. 169. You have stated you have not been able to find any reference in the State specification to the words "radial stretching". What is the language of the State patent in that respect?

A. It speaks of shaping the skirts of the fabric to the sides of the core, and as I just stated in answer to the last two cross-questions, the radial stretching is inherent in the action of the spinning-rolls moving spirally inward while the core is rotating rapidly. Accordingly, radial stretch is done by the machine.

Rd-Q. 170. What do you mean when you say that in the State mode of operation the fabric is "displaced"?

A. At the beginning of the action of the spinning-rolls the skirts are standing outwardly away from the core, and by the time the spinning-rolls get through the skirts have a different place, then hugging the sides of the core. Also, each reticulation of the fabric is differently placed at the conclusion of the action from the

position which it occupied at the beginning. The squares are converted into diamonds or lozenges and thus the threads are "displaced" as compared with the original condition of the fabric.

Rd-Q. 171. What comment, if any, have you to make in connection with Defendant's Exhibit Z, drawing showing limit of inward motion of rolls 30?

A. While this drawing does reproduce, on an enlarged scale, accurately the arrangement of the rolls 30 and their actuating crank shaft 33, it also shows that the crank shaft cannot keep on rotating around and around. The specific illustration indicates the guide bar as at its extreme movement toward the core. Accordingly, the crank shaft would have to be oscillated back and forth and limited in both directions by the illustrated guide slots. I therefore think this would involve a relatively slow action as compared with what would be the case if the crank shaft should be continuously rotated.

I note in this connection that in Defendant's Exhibit H, machine of Mathern Belgian patent, the defendant has so interpreted the Mathern drawings as to avoid any restriction to the back-and-forth movement of the sliding bar which carries the rolls 30, so that the crank shaft may be rotated continuously around and around.

Also, Defendant's Exhibit Z indicates, by dotted lines, the position of the bead.

Redirect-examination closed.

Recross-examination by Mr. Seward:

Rx-Q. 172. You still recollect, do you not, that this Defendant's Exhibit Z is a reproduction of the sketch to which you referred with approval in your affidavit in the Seiberling *v.* Firestone case, which sketch was produced on behalf of Seiberling?

A. Yes.

Rx-Q. 173. With reference to the making of tires by

hand at the Goodyear plant, did you watch fifteen men simultaneously, or one at a time?

A. Both. That is to say, I could first look at one man and then cast my eye along and see what the others were doing.

Rx-Q. 174. About how much floor space did the fifteen men and their apparatus occupy?

A. Quite a good deal of floor space. My recollection is that the men were working in two rows, and I stood between so that I could first look at one side and then at the other.

Rx-Q. 175. And were they about eight or ten feet apart?

A. About that; yes.

Rx-Q. 176. Did you have any difficulty in watching them simultaneously?

A. No, I walked along between the different men and saw what each was doing.

Rx-Q. 177. Referring to Defendant's Exhibit Z, whether the shaft 33 is rotated or oscillated, a reciprocatory movement is imparted to the roller 30; is that a fact?

A. Yes.

Recross-examination closed.

Deposition closed.

Signature waived.

Counsel for plaintiff introduces in evidence a certified copy of the file-wrapper and contents in connection with the application of U. S. Letters Patent of Thropp & De Laski, No. 1,119,326, dated December 1, 1914, marked "Plaintiff's Exhibit No. 15—Thropp & De Laski File Wrapper".

Mr. Seward: I object to the reception in evidence of this document on the ground that the same is immaterial, incompetent and irrelevant.

NEW YORK, N. Y., July 29, 1920.

Present: Parties as before.

Whereupon ALEXANDRE G. H. SPIERS, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says as follows:

Q. 1. What is your name?

A. Alexandre Guy Holden Spiers.

Q. 2. What is your occupation?

A. Professor at Columbia University, in charge of the French and Spanish in the college.

Q. 3. As I understand it, you are descended from a family that has been for some time engaged in the study and teaching of the French language?

A. My grandfather was a professor of English in France. My father and my uncle are still teachers of the French language, one in London and one here. My grandfather has gotten out a French dictionary, and my father a good many French texts.

Q. 4. What is the name of the dictionary that you say your grandfather edited?

A. It was a French-English dictionary and was originally known as, and is still published as Spiers' French-English Dictionary, and another version of it was published in this country as Spiers & Surenne's Dictionary.

Q. 5. I desire to call your attention to the French word "déplisser" and its derivatives "déplissage" and "déplissement", and ask you to say what you regard as the correct translation of these words.

A. Well, in general I should say it meant *to unwrinkle*. It might mean, in a more particular case, *to unplait*. The derivatives you mention have a corresponding meaning of *unwrinkling* or *unplaiting*.

Q. 6. What is the derivation of the French verb "déplisser"?

A. It is derived from "plis", the plural of the word "pli", and it is translated *unplaiting*, the idea being that folds are pressed tight, creating a sharp edge.

Q. 7. That is to say, the word "pli" implies the idea of a tight or sharp crease-like edge?

A. Yes; it is the usual translation for *crease*. It also means, of course, a folding over tight of anything which makes a sharp edge, for instance, as an envelope, which is often called a *pli*.

Q. 8. Would you say that the French words "déplissement" or "déplissage" could be properly translated by the English word *unpuckering*, or *removing puckers*, or *eliminating puckers*, and the like?

A. Not if the French word is used at all strictly.

Q. 9. What are the French words, respectively, for the noun "pucker" and verb "pucker"?

A. The noun pucker is sometimes "poche", that is very often an unintentional pucker of cloth. The verb is translated quite loosely by "froncer", but more particularly by "faire goder". That is the most accurate word for it.

Q. 10. If I am correct, the distinction you draw is that the word "pli" and its derivatives imply the formation of a crease or sharp edge of a certain degree of permanency, which crease or sharp edge is not necessarily involved in the French equivalent of *pucker*. Is that correct?

A. Yes, that is correct. "Goder" is to form a curved surface, that is, a convex or rounded effect, as distinguished from the sharp edge or crease involved in the derivatives of "pli".

Q. 11. Would you say that the French word "déplier" is the proper equivalent of the English word *to unwrinkle?*

A. "Déplier"? No. My explanation is this. I receive

a folded letter and unfold it. That word "unfold" would be the proper equivalent of the French word "déplier".

Q. 12. When you use the word "déplier" in this sense, as for instance when you unfold a letter, does that unfolding eliminate the crease or sharp edge in the paper?

A. No, but it eliminates the making of the thing into two or three thicknesses. It eliminates the tight flattening involved in the word "pli".

Q. 13. And the crease or sharp edged fold in the paper still remains?

A. It may remain. The word "pli" is the word for crease. The idea in the French word "pli" is one of tightness. To explain a little more specifically,—one of the principal authorities draws a distinction between "plier" and "ployer", the former involving the idea of a fold or doubling of the thickness, and the latter involving a mere bending operation. For instance, you use the word "plier" in speaking of a piece of fabric which is folded over, and you use the word "ployer" when you merely bend an article, like the branch of a tree. The authority which I refer to is *Dictionnaire des Dictionnaires.*

Direct-examination closed.

Cross-examination by Mr. Seward:

x-Q. 14. Can you tell me about when the *Dictionnaire des Dictionnaires,* to which you refer, was published?

A. No, I cannot, but I can say that this dictionary is the one which I have heard mentioned in my University courses on the other side.

x-Q. 15. Is that authority available in this city?

A. Yes, in the Columbia library.

x-Q. 16. Can you name any dictionary which gives the meaning of the verb "déplisser" as being *to unwrinkle?*

A. That is a very hard question because I am going

from my use of these things. I cannot say without consulting these dictionaries, but I believe that I can find it.

x-Q. 17. Then, as I understand it, you cannot give the name here and now of a single dictionary which you know translates the verb "déplisser" as to unwrinkle? Is that correct?

A. Yes.

x-Q. 18. Is John Bellows' Dictionary a good authority on the translation of French and English?

A. It's a good working dictionary, not over-accurate.

x-Q. 19. I refer to the one in which it is stated that the author was assisted by Auguste Marrot. Is that the one you have in mind?

A. The one that I know was a small pocket edition. There may have been later editions.

x-Q. 20. How about the dictionary of Ferdinand E. A. Gasc?

A. That is no good.

x-Q. 21. Why do you say it is no good?

A. Because, from the use in my classes made of it by students, I have had to think of dictionaries, and I have told them that it is not to be trusted as an accurate one. It is a thing which may give synonyms to fit this or that phrase.

x-Q. 22. How about the International French-English Dictionary, by Paul Passy?

A. That is a better dictionary.

x-Q. 23. Is that a good authority?

A. Yes, a reasonably good authority.

x-Q. 24. How about Spiers & Surenne's French-English Pronouncing Dictionary?

A. I do not know Spiers & Surenne. I have not worked with it.

x-Q. How about Spiers Dictionary?

A. It is based upon the *Bibliothèque* and other dictionaries. It is one of the most accurate, although it does

not go out of its way to give synonyms and approximate meanings very much.

x-Q. 26. Is that the dictionary referred to as the dictionary of Alexander Spiers, Professor of English at the National College of Bonaparte, Paris, and the National School of Civil Engineers?

A. He was there at one time,—yes, I suppose so.

x-Q. 27. How about the dictionary of E. C. Clifton & A. Grimaux, revised by J. McLaughlin, called "*Nouveau Dictionnaire*—1914"?

A. I know nothing of it.

x-Q. 28. How about the Technological Dictionary, Vol. X, by Tolhausen?

A. If it is the one which I have consulted once in a while, it is too brief to be of any accurate use.

x-Q. 29. How about the dictionary of Deinhardt & Schlomann, a technical dictionary?

A. I don't know it.

x-Q. 30. How about the *Dictionnaire Universel des Synonymes de la langue Francaise*, by Guizot?

A. The mere fact that it is a dictionary of synonyms, seeing that no two words mean exactly the same thing, makes it inaccurate.

x-Q. 31. How about *Petit Larousse?*

A. Reasonably good for practical purposes.

x-Q. 32. You have criticised several of the authorities I have mentioned. Will you tell me what you consider to be good authorities of dictionaries translating French into English?

A. I am sorry to say they are exceedingly few. The proper way to get at the meaning of a word is not by a bi-lingual dictionary. It is by the use of a big dictionary in one language to find out exactly what the words mean.

x-Q. 33. Can you name a good French-English dictionary?

A. As I say, I believe one of the most accurate—the

one which I use to get words for my texts—is the one by my grandfather. I have used the International in preparing one of my texts, and my own experience and that of my collaborators was that while the International gave synonyms, as we say, words that might here and there fit, it did not stick close enough to the really fundamental meaning of the word.

x-Q. 34. Then the one your grandfather wrote, you say, is the only good one?

A. The closest one.

x-Q. 35. Is it the only one you recommend?

A. For students who come to me, it is the only one. And the form having the supplement by my uncle Victor.

x-Q. 36. Can you tell me about when that was published so that I can identify it.

A. My memory of that supplement would be that it came out about 1900, I should think.

x-Q. 37. Then it would be the Alexandre Spiers Dictionary with Supplement by Victor Spiers?

A. Yes.

x-Q. 38. Is that available in this city?

A. They have it in a few bookstores here. The plates were destroyed when the Germans came into one of the towns in the west. But Simkin-Marshall of London used to get it out and they probably still have some. I can get it through my uncle.

x-Q. 39. In your affidavit that you made in the case of Frank A. Seiberling against The Firestone Tire & Rubber Company, you said, "My grandfather was the author of the original Spiers French-English Dictionary, published abroad and subsequently published in this country as the Spiers & Surenne Dictionary". Is that statement correct?

A. So far as I know.

x-Q. 40. Do you know it to be correct?

A. What I know is this. That there were two lawsuits when Surenne came out and it was found impossible to prosecute. The copyright laws have recently been changed and I suppose we still have it, because Appleton wanted to know whether I had new words to put in an edition of the Spiers & Surenne Dictionary, and I referred him to my uncle who has more material than I have.

x-Q. 41. Then, to the best of your knowledge and belief, this Spiers & Surenne Dictionary is substantially a reprint of the Spiers?

A. It is.

x-Q. 42. What does the French word "rider" mean?

A. "Rider" is a word, which in its most usual use, has been narrowed down to one application. In other uses, it is nearer to the original meaning. The original meaning is somewhat like our English "ride", perhaps connected with it when you say your collar rides on your neck. It means a distortion in the sense of folding. As a consequence, because it has come to be applied most generally to the phraseology when speaking of the forehead, it can mean *to wrinkle*.

x-Q. 43. Does "pli" mean a corrugation?

A. I don't know what a corrugation is.

x-Q. 44. You do not have a definite, fixed meaning of the English word corrugation in mind?

A. I do, but I wish to define that meaning before answering your question.

x-Q. 45. What is that meaning you have?

A. My idea of a corrugation is the formation of a rise and fall sharply marked at the apex.

x-Q. 46. Does "plî" mean that either in the singular or plural form?

A. You mean to say "dépli"? Well, no; you would have to come to the derivative of the verb "plisser".

Plisser can mean corrugate in this sense which I have given it.

x-Q. 47. Then, would "déplisser" mean to remove corrugations in the same sense you have given it?

A. Only in that sense in which I have given it.

x-Q. 48. Does "pli" mean a tuck?

A. If I know what a tuck means, it does not.

x-Q. 49. What do you understand a tuck to mean?

A. A pulling up of material so as to shorten it. A tuck, as I look at it, has no special characteristic of form. It may be loose. It usually is loose.

x-Q. 50. Then your understanding of "pli", if I am correct, is that its meaning is limited to a fold having a sharp crease. Is that right? With the emphasis on the fact that the crease is sharp.

A. Yes, and the fold is tight.

x-Q. 51. It hasn't a broader meaning than that?

A. It might in occasional senses, but it hasn't really. As an example of this I take the meaning of "plier", which is to put away a thing in compact form, as linen. "Plier le linge" means to take it when it has been ironed, double it on itself compactly so that it may be put away.

x-Q. 52. The purport of my question was to ask you whether or not the word "pli", as you understand it, is limited to mean a fold including a sharp crease, and that it does not have a broader meaning.

A. It very rarely has a broader meaning. I cannot foresee a case.

x-Q. 53. What is the difference between the meaning of the words "plisser" and "plier"?

A. "Plisser", formed on the plural, means the formation of a whole group or quantity of *plis*, with the further connotation in ordinary parlance that they are small.

x-Q. 54. That is, perhaps stating it another way, that the root, or whatever you call it, of "plisser" is "plis", which is the plural of the noun; whereas, the root of "plier" is "pli", which is the singular of the noun?

A. That explains half of my answer. The other half is that involving a number of folds. The connotation is that these folds are smaller, producing a surface sharply marked by edges or creases, as, for example, "une chemise plissé", a plaited shirt.

x-Q. 55. What is the difference between a pucker and a plait?

A. My idea of the difference between a pucker and a plait is that the plait is flat with a sharp edge. A pucker gives a bulge or convex curved surface.

x-Q. 56. And you understand the word pucker is limited to irregularity of a rounded nature?

A. Yes, I do.

x-Q. 57. May I ask just once more if you understand that the word "pli" means a fold like the fold made in letter paper when you fold it to put it in the envelope, and that it is limited to such a fold?

A. The fundamental idea in the word is that, including, of course, the crease or the sharp edge. Careless or figurative speech might distort that fundamental connotation.

x-Q. 58. What might that careless or figurative speech use the word "pli" as meaning? What did you have in mind when you made that remark?

A. Simply inaccurate use of words which we find in all sorts of connections.

x-Q. 59. Can you give an illustration of this loose or figurative use of the word "pli"?

A. I cannot, for the moment.

x-Q. 60. What is the French word for ruffle?

A. I am afraid I could not tell you what the French word is for ruffle.

Cross-examination closed.

Deposition closed.

Signature waived.

NEW YORK, N. Y., August 9, 1920.

Appearances: Same as before.

Whereupon FREDERICK RAY, a witness called on behalf of the plaintiff, having been already sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 1. You are the same Frederick Ray that has already given a deposition in this case?

A. I am.

Q. 2. Will you state whether or not you have made any comparative strength test as between tire carcasses made on Goodyear commercial machines and tire carcasses made by hand spinning?

A. Yes, I have conducted such tests.

Q. 3. Who made the experimental tires by the hand spinning method?

A. Mr. Arthur Mackey.

Q. 4. And who made the tires on the Goodyear commercial machine?

A. Mr. Albert Shaw.

Q. 5. Were these tires substantially the same, with the exception that one set was made by hand spinning and the other set on the Goodyear commercial machine?

By Mr. Seward: I object to any testimony as to the tests mentioned, on the ground that the same is immaterial, irrelevant and incompetent.

It is agreed by Counsel that this objection may stand without repetition.

A. Yes, they were the same, as near as it was possible for us to make them, in every respect.

Q. 6. How many plies were employed in each set of tires?

A. There were five plies.

Q. 7. And was the material the same in both instances?

A. Yes.

Q. 8. How do you know that the material was the same in both instances?

A. I gave orders, of course, that it should be the same, and I saw all of the material that was used in both sets of tires; and, furthermore, I saw the thickness of the material measured, in some cases took the measurements myself.

Q. 9. And were the beads the same in both sets?

A. Yes, the beads were the same standard beads such as the Goodyear Company used for these sized tires.

Q. 10. Were chafing strips supplied in both sets of tires?

A. Yes.

Q. 11. And were these chafing strips the same?

A. They were the same in all respects.

Q. 12. And how about the rubber cover, was that the same in both sets of tires?

A. Yes, the rubber cover was the same. The standard material such as would be used on these sized tires for finishing them as far as they were finished.

Q. 13. Did you see these tires, both sets of tires, actually made?

A. Yes, I was present and saw them made.

Q. 14. Mr. Mackey made the tires by hand spinning?

A. Yes, he did.

Q. 15. And Mr. Shaw made the other tires on the standard Goodyear commercial machine?

A. Yes, Mr. Shaw operated the machine.

Q. 16. Did you see the tires finished after the five plies had been laid in each set, respectively?

A. Yes, I saw them finished.

Q. 17. And that finishing operation was the same in both instances?

A. Yes, I saw them finished.

Q. 18. And that finishing was the same in both instances?

A. Yes, it was the same.

Q. 19. And what do you know about the curing or vulcanizing of these tires, was that the same in both sets?

A. Yes, that was the same. I directed that they should be both cured the same, and fully cured in the one step, so that the carcasses would be in the same condition as the normal tire is in use, as near as it was possible to do so.

Q. 20. Was a tread applied to the tires being considered?

A. No, no tread was applied.

Q. 21. Why did you omit the tread?

A. I was only interested in the strength of the carcass, and the tread would have no bearing on this, and in fact might obscure the relative strengths of the two types of carcass.

Q. 22. Are you able to produce any records or charts relating to the curing of these respective sets of tires?

A. Yes, I produce herewith charts from the Bristol recording thermometers which are connected to the vulcanizing chambers in which these two sets of tires were vulcanized.

Q. 23. What, if you know, do these charts indicate?

A. These charts indicate the temperature of the steam within the vulcanizing chamber, and the length of time during which this temperature of steam was maintained.

Q. 24. Will you kindly mark in blue pencil on the two charts you are testifying about, the two indicating lines which respectively refer to the two sets of tires in question?

A. I am marking an M on the chart dated May 27, 1920, as to the best of my memory Mackey's tires were vulcanized first, and there is no other way of telling

these charts apart; and an S on the one dated May 28, 1920.

Q. 25. Why did you select the letter "S" in connection with the machine made tires?

A. I took it from Mr. Shaw's initials.

Q. 26. Do I understand that the "M" on the other chart is Mr. Mackey's initial?

A. Yes, that is why I selected the M.

Q. 27. There are other cures also indicated on these two charts, are there not? Do these other cures relate at all to the two sets of tires we are discussing?

A. No, they relate to the standard work which was going on before and after these particular tires were cured.

Plaintiff's counsel introduces in evidence the two charts referred to, marked "Plaintiff's Exhibit No. 17, Vulcanizing Charts".

By Mr. Seward: I object to the reception of this proffered exhibit, on the ground that the same is immaterial, irrelevant and incompetent; and it is agreed that this objection may stand without repetition as against all other exhibits which may be offered referring to all tests made by the witness.

Q. 28. How are these respective sets of tires marked?

A. The tires which were made by Mr. Mackey by hand spinning, are marked with M in red rubber and with, following the M, numerals 1 to 10, each tire carrying its number. The tires made by Mr. Shaw are marked with a capital S in red rubber, followed by the numerals 1 to 12. These markings were placed on the tire by Mr. Shaw as soon as they were finished, and were observed by me at that time in all cases. When vulcanized, the markings remained permanently in red.

Plaintiff's counsel introduces the two sets of tires in evidence, marked, respectively, "Plaintiff's Ex-

hibit No. 18, Hand Spun Tires" and "Plaintiff's Exhibit No. 19, Machine Made Tires".

Deposition of witness suspended to permit the depositions of Messrs. Bedell and Rowles.

Whereupon FREDERICK RAY resumed the stand, and in answer to further interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 29. Did you observe closely Mr. Mackey when he was making the tires embodied in Plaintiff's Exhibit No. 18?

A. Yes, I observed him carefully all the time.

Q. 30. Was his work competent and successful?

By Mr. Seward: Objected to as incompetent and calling for a conclusion.

A. Yes. In my mind Mr. Mackey was a very skilful tire maker, and the work which he did on these tires was very carefully and perfectly done.

Q. 31. What is your recollection as to whether or not Mr. Mackey finished the tires, put on the rubber elements, the beads, etc.?

A. Mr. Mackey stretched all the fabric onto the cores; did all the spinning down of the fabric on the sides of the cores; and applied most of the beads. He also, of course, spun the fabric lying outside of the beads, down to the beads. This was all done in accordance with the Goodyear standard practice, which does not permit of the fabric being spun over the beads in the first operation of the carcass making, but leaves this to a second operation of finishing by hand, and this same practice was followed in making these tires. Mr. Mackey finished a number of them, that is, he finished the laying of the fabric about the beads, but in order to assist him and save time the others were finished by a regular employee of the Goodyear Company who does this work, whose name I do not know.

This man also applied the rubber covering and the chafing strip about the bead.

Q. 32. You say that Mr. Shaw made the tires embodied in Plaintiff's Exhibit No. 19 on the State machine. Was this machine the customary Goodyear commercial machine?

By Mr. Seward: Objected to as incompetent and indefinite.

A. Yes. These tires made by Mr. Shaw were made on one of the Goodyear machines which I have seen from time to time in regular production,—in fact I have always so observed it, except in this particular case. This machine was one of the dozen or two of the older model State machines which have been in operation for many years.

Q. 33. Referring again to these tires of Plaintiff's Exhibit No. 19, were they made in the usual manner which you say you have observed from time to time?

A. Yes. These tires were made just the same as all that I observed of this type.

Q. 34. Was there anything unusual or extraordinary in their manufacture?

A. Nothing whatever that I know of.

Q. 35. I understand that it was your purpose to have the two sets of tires, hand-spun and machine-made respectively, made exactly alike except in so far as the different mode of stitching the fabric on the sides of the core is concerned, is that correct?

A. Yes. That was my intention, and I used every effort to see that it was carried out and believe that it was so carried out.

Q. 36. Were these machine-made tires finished in the same way as the hand-spun tires?

A. Yes. They were finished in the same manner, by the regular finishers who are located in this room close

to these tire machines, and who do the regular finishing upon the standard product.

Q. 37. How about the bead application?

A. The bead application on these tires made in the machine of course is done in the machine itself, that is, the man operating the machine applies the bead. But the fabric, of course, is placed around the bead by the hand finishers.

Q. 38. In the same way as in the hand-spun tires of Plaintiff's Exhibit No. 18?

A. In exactly the same way.

Q. 39. And what about the application of the rubber cover or cushion?

A. That was applied in exactly the same way; Goodyear standard practice all the way through, as I have observed.

Q. 40. You said in a previous answer that you subjected these tires to a comparative test to determine their respective strength. Generally speaking, what was the nature of that test?

A. The tires were subjected to an internal hydraulic pressure until each one burst, the pressure required to burst being observed and recorded.

Q. 41. Why was it you selected this hydraulic bursting test to indicate the bursting strength of the tires?

A. It seemed to me to be the only test which would give a fair comparison of the relative strengths of the two tires; and furthermore it subjected the tires to stresses of a similar nature to those which they have to withstand in service.

Q. 42. Do you regard the so-called tire tests obtained from employing them on automobiles, as certain in their results?

A. No, I do not for this purpose, because too many different conditions, uncontrollable conditions, come into effect in the road test, and it seems to me that it

would be quite impossible to arrive at any proper comparative results by such methods.

Q. 43. Do you know whether or not this method of obtaining the comparative strength of tires by the application of internal hydraulic pressure, had ever been employed by the Goodyear Company before for the same purpose?

A. I had been informed that they used it extensively in the past, and I know that recently they have been employing it in connection with the cord tires.

By Mr. Seward: I object to the part of the answer in which the witness states he was "informed" as to certain things, that is hearsay, and move to strike it out.

Q. 44. Do you regard the test employing the internal hydraulic pressure, as a searching one?

A. Yes. Every part of the tire is subjected to this pressure, and any weakness existing is disclosed.

Q. 45. Generally speaking, and omitting the consideration of occasional instances, what is the principal way in which a tire is finally destroyed in use?

By Mr. Seward: Objected to as incompetent.

A. It has been my experience that when the tire becomes worn to a certain extent, it usually fails finally by bursting.

Q. 46. Does this application of internal pressure subject the tires to the character of forces that the carcass is generally intended to withstand?

A. Yes. The stresses set up are the same to all practical purposes.

Q. 47. Will you now give us an idea or description of the character of the apparatus you employed in your tests, and how you used it?

A. I have here a sketch showing the cross-section of

a tire mounted in the special bursting apparatus which we constructed for this purpose.

Q. 48. Will you describe it briefly?

A. This bursting apparatus was nothing more or less than an extra strong rim, made in halves, so as to support the tire in a manner similar to an ordinary rim. In addition to this there was an inner ring, which I have called a "bull ring" in the sketch, the purpose of this ring being to clamp the beads of the tires against the sides of the rim and to prevent them from blowing out under the high pressure required to burst the tire. An inner tube was used inside the tire in the usual manner, and the hydraulic pressure was brought in to the inner tube through the usual valve stem, the valve, however, being removed.

Plaintiff's counsel introduces the sketch in evidence, marked "Plaintiff's Exhibit No. 20, Ray Holding Device".

Q. 49. Will you continue your description of the particular bursting apparatus you used in connection with the holding device you have just been discussing?

A. The hydraulic pressure was connected to the valve stem by means of a flexible hose, which in turn was connected to a source of hydraulic pressure,—the hydraulic pressure line of the factory in which existed a pressure of fifteen hundred pounds, approximately. In these connections there was located a needle valve to permit the water to flow to the tire, a six hundred pound test gage to indicate this pressure, and a waste connection controlled by a valve so that the pressure could be removed if desired. I present a sketch indicating the general arrangment of these features.

Plaintiff's counsel introduces sketch in evidence, marked "Plaintiff's Exhibit No. 21, Ray Bursting Apparatus".

Q. 50. You say that the hydraulic pressure you employed in your tests was obtained from the regular hydraulic pressure device already in existence at the Goodyear factory. Are you able to say for what purpose that hydraulic pressure was employed prior to your test?

A. I know for one thing that it is used in connection with the vulcanizers to operate the hydraulic ram which holds the molds together. I have seen other apparatus in the factory which is also operated hydraulically but cannot state exactly now what it was.

Q. 51. Do you know whether or not this hydraulic pressure has been employed for the purpose of testing hose, or tires, or other articles of that kind, prior to your test?

A. I know that it had so been used. In fact we conducted these tests in a laboratory or a room which was specially set aside for this class of work and was in use before we conducted these experiments.

Q. 52. Do I understand that in conducting your tests you burst all of the tires comprised in Plaintiff's Exhibits Nos. 18 and 19, respectively?

A. Yes, we burst all these tires.

Q. 53. State briefly in what way you allowed the hydraulic pressure to be imparted to the inside of the respective tires and whether or not you recorded the bursting pressure of each tire.

A. After mounting the tire upon the holding rim and bolting same together as tightly as possible, we subjected it to an air pressure of approximately eighty pounds to inflate the inner tube and get it to fit smoothly inside the tire. We then allowed this pressure to escape by removing the air hose, the valve already having been removed, until the air within the tire was of ordinary atmospheric pressure. The hydraulic hose was then connected to the valve stem and we allowed the water to flow into the tire until it was practically full of water, with the exception of the

air, up to a pressure of one or two hundred pounds; we then slowed down the flow until it flowed in very slowly, and observed the increase in pressure shown on the test gage; by the use of the needle valve we were enabled to keep the flow of water into the tire down to such a small rate that the pointer of the pressure gage moved extremely slowly. We followed this in its movements very carefully, reading off the pounds as it increased, until the tire burst; we then made a record of the maximum pressure shown by the gage at the time of bursting.

Q. 54. Next state the respective pressures at which the hand-made tires comprised in Plaintiff's Exhibit No. 18 burst, respectively.

A. The hand-made tires, marked, respectively, M^1 and M^2, etc., to M^{10}, burst at the following pressures:

M^1	395,	M^6	408,
M^2	393,	M^7	358,
M^3	393,	M^8	396,
M^4	392,	M^9	391,
M^5	364,	M^{10}	391,

the average of these ten amounts being 388.1.

Q. 55. Next state the respective pressures at which the machine-made tires comprised in Plaintiff's Exhibit No. 19 burst, respectively.

A. The machine-made tires marked, respectively, S^1, S^2 to S^{12} burst at the following pressures:

S^1	480,	S^7	442,
S^2	450,	S^8	408,
S^3	421,	S^9	409,
S^4	405,	S^{10}	449,
S^5	424,	S^{11}	462,
S^6	425,	S^{12}	454,

the average of these twelve amounts being 435.75.

Q. 56. Did you have any difficulty whatever in holding

the beads in connection with the bursting of the hand-made tires?

A. No, we had no difficulty in connection with bursting these tires.

Q. 57. Did you have any difficulty whatever in holding the beads in connection with the bursting of the machine-made tires?

A. Yes. We had considerable difficulty in holding the beads. These beads alone will carry a pressure in the tire of approximately 350 to 360 pounds, and, as the hand-made tires require only about 30 pounds or so more to burst them, we had no difficulty in clamping the test rims tight enough together to hold this additional amount. In the case of the machine-made tires, however, the pressure required to burst being so much greater, it required a great deal of care on our part to hold these beads; and in the case of tire 8^2, the bead blew out before the tire burst, notwithstanding our care in trying to hold it. I might add that it required a great deal of preliminary experimenting on our part to be able to hold these machine-made tires.

Q. 58. What is the approximate difference in percentage between these respective bursting averages in favor of the machine-made tire?

A. 12.3 per cent. That is, it required 12.3 per cent. more pressure on the average to burst the machine-made tires than it required to burst the hand-made tires.

Q. 59. What is the normal service pressure employed in connection with 34-4 tires such as are comprised in Plaintiff's Exhibits Nos. 18 and 19?

A. Approximately 75 pounds.

Q. 60. Approaching the subject from this standpoint, what would the respective safety margins be?

A. The machine-made tire would have a margin of safety of 15.2 percent. greater than the hand-made tire.

Q. 61. How do you arrive at this later figure?

A. I have subtracted 75 pounds from each of the average bursting pressures and arrive at 360.75 pounds as the remainder in the case of the machine-made, and 313.1 pounds as the remainder in the case of the hand-made tires, the first figure being 15.2 percent greater than the latter.

Q. 62. Do you regard this percentage of safety margin in favor of the machine-made tire as arithmetically correct in indicating the greater longevity of the machine-made tire?

A. I consider that the life of the machine-made tire would be very much greater, as compared to the life of the hand-made tire, than indicated by these relative factors of safety. These factors of safety apply to the two tires when they are new; as depreciation goes on, due to the use of the tire, caused by the movements of the fabric due to use, the relative factor of safety of the machine-made tire becomes greater and greater as compared to the hand-made tire. The result of this is, in my opinion, that the life of the hand-made tire would be much less proportionately than is indicated by the relation between these two factors of safety from that point of view alone. Furthermore, since the fabric of the two types of tires is identically the same, as near as it is possible to make such fabric, and treated the same in its cure, the fact that the hand-made tires burst at a lower pressure than the machine-made tires shows that at any given pressure, the same for both tires, the stresses in the hand-made tire are higher than those existing in the machine-made tire. In other words, under the standard inflation pressure, the stresses set up in the hand-made tires would be greater than those set up in the machine-made tires. As a result, the effect of the flexure or bending of the fabric, which is continually occurring at every revolution of the tire, would be more pronounced in the hand-made tire in causing the fabric to depreciate or lose its strength

than it would be in the machine-made tire. Thus, it is my opinion that after usage is begun the difference between the remaining factors of safety in the two tires would tend to become greater and greater very rapidly. Furthermore, one of the common causes of failure of tires is due to what is known as stone bruises, which are caused by the tire running over some comparatively small object like a stone, which makes a sharp indentation into the tire; this causes a high bending stress in the fabric of the tire, the tensile stress being on the inside of the tire and the compressing stress on the outside at the middle portion of the tread. This tensile stress due to this bending action combines with the tensile stress due to the internal pressure and frequently results in a rupture beginning at the inner layer of fabric. The additional factor of safety which the machine-made tire has over the hand-made tire would be extremely important in preventing this rupture.

By Mr. Seward: I move to strike out the answer as incompetent and as secondary evidence, it being theoretical when practical evidence is obtainable.

Q. 63. Previous to the tests you have just described as between the tires of Plaintiff's Exhibit No. 18 and Plaintiff's Exhibit No. 19, had you made any similar tests?

A. Yes.

Q. 64. Will you state under what circumstances and for what purpose?

A. In connection with the various studies which I had made regarding the strength of tires, it seemed plain to me that the hand-made tire would not be as strong as the machine-made tire, and in order to determine whether or not my theory in this regard was correct, I had constructed a number of hand-made tires and a number of machine-made tires, and I burst these tires in an exactly similar manner to that already described, and found that my theory was verified.

Q. 65. Was this preliminary test of yours initial, and caused you to proceed with the second main tests that you at first outlined?

A. Yes. It was for the object of determining whether it would be worth while or not to obtain a Diamond operator and make up tires just as they were previously constructed by the hand-spinning method and compare them with tires made by machine.

Q. 66. Who made these preliminary tires for you?

A. Mr. Shaw made both the hand-made tires and the machine-made tires.

Q. 67. Would you state briefly and without going into extreme detail, the results you obtained in these preliminary tests?

A. I burst four machine-made tires at an average pressure of 429.5, and three hand made tires at an average pressure of 383.6, the difference in percentage between these two average pressures being substantially the same as I have given them in connection with the main test, which statement is true also in connection with the percentage in the difference of margin of safety which was similarly in the neighborhood of 15 per cent.

By Mr. Seward: I move to strike out this answer where it refers to the margin of safety, as incompetent and secondary evidence, it being theoretical when practical evidence is obtainable. It is also understood that the objection made at the beginning of Mr. Ray's deposition applies to the tests referred to in the preceding answer.

Q. 68. In referring to this preliminary test, you have described the tires as "machine-made" and "hand-made" respectively. I assume you mean by this, tires made on the State machine, and tires made by the hand-spinning method. Is that correct?

A. Yes. The "machine-made" tires were made on

the machine of Plaintiff's Exhibit No. 2, and the "hand-made" tires were spun by hand in the usual manner.

Q. 69. You stated that at different times and on different occasions you have seen the Goodyear commercial machines in practical operation. Will you say whether or not the quality of the work you saw performed thereon was good or bad?

A. As far as I have observed this work, and it has been very frequent within the last three years, the quality of the work has been uniformly good. It is very seldom that any wrinkles are formed on the machine in spinning down the fabric.

Q. 70. Can you say whether or not in the observation of these commercial Goodyear machines, you have noted spinning the fabric around the beads by the spinning rolls?

A. Yes, I have observed this in the case of the machines used in making "Clincher" type of tires, in No. 2 plant.

Q. 71. How recently have you seen this practice of spinning around the beads with the spinning rolls?

A. About the middle of last winter or early this spring, the last time I was over at the No. 2 plant.

Q. 72. I direct your attention to the testimony of defendant's expert, as follows (italics mine):

> "At the center of the shaft is an adjustable clutch member 71 which is keyed to the shaft, but is capable of sliding thereon to engage with either one or the other *of two worm wheels or spiral gears as the specification calls them*, 75 and 83, which bear corresponding clutch members 72 and 73."

and again:

> "The high speed was 120 R.P.M. instead of 207 and the gear mechanism which produced it occupied the position of the wheel and worm 75, 76 in Fig. 3

but *were not a wheel and worm but on the contrary were a pair of spiral gears* having a different ratio of diameters and a speed ratio of 1 to 1 instead of 45 to 1."

and again:

"The patent further says that the other one of the two worm and gear combinations is 'just as' the first. Mr. Browne's sketch Defendant's Exhibit A, does not show such an arrangement but on the contrary presents a problem (not a solution) *in spiral gearing.*"

and again:

"I may note that in the Goodyear machines which I saw, even though the speed requirement was much less exacting, namely only about 120 R.P.M., the high speed gear mechanism had been re-designed, *the worm wheel being abandoned and a pair of spiral gears of approximately equal diameter substituted therefor.*"

and again:

"Thus the members corresponding to *the worm 76 and worm wheel 75 are in Exhibit No. 2, a pair of spiral gears* which furnish the high speed drive instead of the low speed drive as Mr. Browne interprets the State patent."

and again:

"The low speed shaft 78 is driven at a reduced rate from the high speed shaft instead of the reverse as in Mr. Browne's interpretation of the patent and for the high speed drive *the worm and worm wheel have been replaced by a pair of spiral gears.*"

From these quotations, Defendant's expert would apparently seek to establish a difference between worm

gearing and spiral gearing. Will you say whether or not you recognize the distinction thus sought to be established?

By Mr. Seward: Objected to as not rebuttal evidence; this having been gone into by plaintiff on *prima facie*.

A. No, I do not.

Q. 73. Will you give your reasons for your answer, basing them on your experience as a machine designer and a mechanical engineer?

By Mr. Seward: Same objection; and it is agreed this may stand to all testimony on this point without repetition.

A. I have long been familiar, personally, with spiral gearing, and have been familiar with the usages of the word "spiral" gearing and "worm" gearing, and know in the first place that there is just one type of gear involved here, namely, a spiral gear. Usage differs, however, among different people in describing these gears, some people calling a particular gear a "worm" gear and others calling it a "spiral" gear. From an exact technical standpoint, however, there is only one type involved, which is in fact, properly speaking, a helical gear, the word spiral being inaccurately used but nevertheless commonly used by many people.

Q. 74. How far back does your experience go in this subject-matter?

A. I made a study of the subject of gearing when attending Stamford University, between 1897 and 1899, and did the usual designing on such gears included in a course in machine designing, and from '99 on I had occasion to design various gears of these types for actual use, and did so design many such gears.

Q. 75. Do you recall any instances early in this cen-

tury of the use of such gearing as is now under discussion?

A. I remember, about the year 1902, seeing a good many gasoline engines in which such gearing is used between the crank shaft and the shaft used for lifting the valves and operating the spark. These engines which I have in mind particularly, were made by the Otto Gas Engine Company, of Philadelphia, the concern which I worked for at that time being agents for them, and all of these engines used what was ordinarily called spiral gears for the speed reduction. Other gasoline engines also used them, about the same period. In fact, they were quite common, although the particular names of the other engines I cannot recollect at the moment. I also, personally, had occasion to design a small pump which was driven by similar gears; that was about the same period, in fact I was employed at that time by the same firm.

Q. 76. I will next ask you to look at the State patent in suit, and state whether or not the terms "spiral" and "worm" are used in any discriminating or distinguishing sense.

A. I notice, beginning at the bottom of page 3, line 123, the specification states:

> "The clutch member 72 is provided with a hub 74 rigidly secured to a *spiral gear* 75 adapted to be driven by means of a *worm* 76 mounted on the shaft 58 just as the corresponding clutch member 73 has a hub 84 secured to a *spiral pinion* 83 driven by a *worm* 82 on a shaft 78. The shaft 78 is driven from the shaft 58 by a chain and sprocket connection and the arrangement is such that the *spiral gear* 83 rotates much more rapidly than the *spiral gear* 75." (Italics mine.)

In this instance the word "spiral" is used four times and the word "worm" is used twice, describing the same gear transmissions.

Q. 77. Do you know whether or not there are any other references to "spiral" or "worm" in the patent?

A. I believe there are not, as far as I have been able to find.

Q. 78. Will you next state whether or not you are able to produce any authorities bearing on this same subject, namely, the interdependence and relation of "worm" and "spiral" gearing?

A. Yes, I can.

Q. 79. Are there many or few authorities that you have in mind?

A. Oh, there are numerous authorities.

Q. 80. Will you produce a few of them?

A. I find in the Standard Dictionary, near the bottom of the last column of page 1015, the following definition of spiral gear: "a gear having teeth arranged spirally or worm-fashion about its circumference".

I also refer to the American Machinist Gear Book, published in 1915 by the American Machinist. I refer particularly to pages 163 and 164, wherein the close relation of worm and spiral gearing is clearly indicated.

By consent of Defendant's counsel, without waiving the former objections, Plaintiff's counsel introduces in evidence photostatic copy of the two pages in evidence, marked "Plaintiff's Exhibit No. 22, Pages 163 and 164, American Machinist Gear Book".

I also refer to "The Theory of Machines", published by McGraw-Hill Book Company, Inc., of New York, in 1917, and call particular attention to page 102 whereon appears an article entitled "Spiral or Screw Gearing", and under which appears a sub-heading "119. Worm Gearing"; and also to pages 106 and 107, and particularly therein the article beginning with a sub-heading "124. Screw Gearing".

Plaintiff's counsel similarly introduces in evidence photostatic copies of pages 102, 106 and 107,

referred to by the witness, marked "Plaintiff's Exhibit No. 23, Pages 102, 106, 107, The Theory of Machines".

I also call attention to "Pure Mechanism" published by Henry Holt and Company, of New York, in 1914, and particularly to pages 261 and 262 thereof.

Plaintiff's counsel similarly introduces in evidence photostatic copies of the two pages referred to, marked "Plaintiff's Exhibit No. 24, pages 261 and 262, Pure Mechanism".

These are merely selections from a number of works at my disposal, and require no comment as all of them clearly indicate the close relation of the worm and spiral gearing and the interchangeability of the terms.

Adjournment until Tuesday morning, August 10, 1920.

NEW YORK, N. Y., August 10, 1920.

Met pursuant to adjournment.

Appearances: Same as before.

EXAMINATION OF MR. RAY CONTINUED:

Q. 81. I next direct your attention to the following pasages from the deposition of Defendant's expert:

"The worm gear drive in typical form is one in which the worm rotates very much faster than the wheel; for example, in Fig. 4, the worm 76 rotates 46 times while the wheel 75 rotates once. If the wheel 83 is to be the high speed drive and to realize the speed set forth in the specification (207 R.P.M. for the shaft 90), then obviously the drive 83 must rotate 103½ times while the shaft 78 rotates only 90 times. In other words, the worm gear mechanism must actually have an *increasing* ratio instead of the usual greatly decreasing ratio."

and also:

> "I do not desire to be understood as saying that in machine illustration in general or where *usual* gear combinations are indicated, it is necessary that the drawings should show the specific details of the gearings as to the number of teeth and the like, but *in this instance a most unusual and extraordinary ratio* seems to be required, *a ratio so far as I know which has never been attained by worm gearing. Such a problem is not one for the ordinary mechanic* but is one which, if solvable at all, is only solvable by virtue of the skill and ingenuity of some gear specialist." (Italics mine.)

Will you state whether or not you regard the so-called "problem" as an unusual one or one difficult of solution?

A. No, I do not consider it either unusual or at all difficult of solution. If we are to consider the problem on the basis of following the exact proprtions shown in the patent drawing, then I find that it would require a pair of spiral or worm gears for the high speed drive, in which the angle of the threads or teeth of the pinion or driving gear would be 30° measured from the axis of the shaft. Consequently, the teeth of the driven gear would make an angle of 60° with the axis of the shaft. This would make the ratio of the number of teeth on the pinion to the number of teeth on the gear equal to 24 to 23. There is no difficulty whatsoever in cutting gears with the teeth which make these angles, and all the information necessary for both calculation and the cutting was well known prior to the year 1907.

Q. 82. Will you please state what data are ordinarily given machine shops for the manufacture of gears of this description?

A. It is usual to give the pitch diameters of the gears; the size of tooth to be used, expressed in either diametral

pitch (which means the number of teeth per each inch in diameter), or in circular pitch (which means the distance occupied between similar points of two teeth upon the pitch circumference); the angles of the teeth; and the number of teeth upon each gear. Of course, from the dimension of the pitch diameter and the number of teeth, it would be possible to calculate the size of the teeth to be used, or *vice versa*, from the pitch diameter and size of the teeth it is possible to calculate the number; but it is usual to give these four particulars, in addition to which, of course, the other dimensions such as the width of the face and bore, etc., are usually given, although they are not directly related to the problem.

Q. 83. Boiling down the answer to the last question, I understand that the four more important particulars necessary or desirable, and without the extended explanation you gave in the last answer, are: (1) pitch diameter, (2) size of tooth, (3) angle of tooth, and (4) number of teeth, is that correct?

A. Yes.

Q. 84. And as a matter of fact, I understand that either the number of teeth or the size of tooth could be omitted when the pitch diameter is given, is that correct?

A. Yes.

Q. 85. Can you state what power is necessary to drive a machine like the State machine under discussion?

A. Not over 2 H. P. is required to drive one side of the State machine at 207 R.P.M.

Q. 86. I next direct your attention to the following statements appearing in the deposition of Defendant's expert:

> "It is my opinion that no such arrangement could have been intended by the patentee and, so far as I know, it is *impracticable*. My opinion is that, assuming the same size blanks, as the drawings clearly

show and the specification clearly implies, it would be *impracticable to get a ratio of speeds* of the wheel 83 to drive the shaft 78 better than about 5:1 if the gears are to be proportioned to transmit the same amount of power. Of course gears of a lower ratio could be made if higher speeds could be employed or if lower power and freedom from shock would suffice. The specification, however, fixes the speed at 207, and under the conditions named *it is my opinion that a ratio of 1:5 is the best that could be obtained.* This would mean that the wheel 83 makes one revolution, while the shaft 78 makes 5 revolutions." (Italics mine.)

and again:

"The reason why the worm and wheel combination 82, 83 could *in my opinion not be constructed* for a ratio higher than about 1:5, is that *it would not seem possible to get on blanks of the relative size of those indicated in the drawing* (and of the actual size that I would understand would be used in practice) *the required tooth dimensions to stand the shock strains.* Of course on paper it is easy enough to draw lines indicating a certain number of teeth and certain tooth angles which, if they could be built, would run at the required ratio if they had no work to do. Machines, however, are built to do work and to withstand certain shocks and strains, and gearing combinations, as well as all other parts, are designed by starting with the permissible dimensions and strains as a basis. The difficulty in designing a worm gear for such abnormal speed ratio as would here be required, is that *it is difficult or impossible to get a sufficient "root thickness" for the teeth*, and at the same time have such a number of teeth as is required for the speed ratio and to transmit the shocks at the actual required speeds." (Italics mine.)

and again:

> "I am satisfied, however, that for the speeds proposed the same horse power transmitted and with the general dimensions that I understand would apply *the ratio of 5:1, which I have given is not very far from the correct one, as the limit, and if forty-five teeth is to be regarded as fixed for the gear 83, then I would be still more positive in my statement that a better ratio could not be expected.*" (Italics mine.)

Would you state whether or not you regard these criticisms as sound, and whether or not such an arrangement as thus discussed is an impracticable one?

A. I do not agree with Defendant's expert's conclusions at all, and can see nothing whatever impracticable about the required construction. Defendant's expert states that a ratio of 5:1 is about the lowest that could be used to transmit the power. The facts are that a ratio of 5:1 would be about the highest ratio that should be selected if an efficient, durable set of gears were to be made. A 1:1 ratio would give gearing of the maximum efficiency and durability, which is practically the ratio required. When I speak of a ratio of 1:1, I am treating it as a higher ratio than 1:5, or a lower ratio than 5:1.

In the second quotation, Defendant's expert gives his reason for not being able to get a higher ratio than about 1:5, as being due to the fact that it would be impossible to get the required tooth dimensions to stand the shock strains on the gears of the size indicated on the patent drawings when enlarged to the actual size of the machine. In my opinion, the question of tooth dimensions has nothing to do with the subject whatever, as it is possible to use almost any size tooth within a wide range, without regard to the size of the gears. Of course, in the usual system of gearing, it is generally impractical to use less than 12 teeth in a gear, owing to the fact that the teeth

become under-cut when a fewer number are used and thus weakened. This minimum of teeth refers, however, to spur gearing more particularly, and in spiral gearing it is possible to use a fewer number of teeth than in spur gearing because, due to the angle, they do not become so under-cut. In the actual size of gears used in the full sized machine, however, and even if kept in exact proportion to the patent drawing, the size of tooth required to transmit power is such that the number of teeth becomes very much greater than the minimum, so there is no difficulty whatever on this score.

In the third quotation from Defendant's Expert's deposition referred to he further states his reason for setting the ratio of 5:1 as the limit, as being due to the use of 45 teeth in the low speed gear. I have gone over this matter and find that this limitation of 45 teeth does not affect the high speed transmission, as Defendant's expert has indicated; using such a number of teeth in the low speed gear still permits a tooth of ample size in the high speed gear to transmit the power required.

Q. 87. I also call your attention to the following statement from the testimony of Defendant's expert:

> "This problem would have to be solved either by calculation or *experiment, probably the latter, before anyone could tell whether teeth of proper proportion to stand the strains and transmit the necessary power could be cut of the required number and at the required angle on blanks of the relative diameters given and have the necessary strength.*" (Italics mine.)

What have you to say in connection with this statement?

A. It would only be necessary to make a simple calculation to determine the size of tooth and all other data needed to build these gears to transmit the necessary horse power. All the necessary data was well known

prior to 1907 and, of course, was based on experiments which had been conducted on gears for many years past. In fact any designer of ordinary ability could easily have designed these gears without experimentation.

Q. 88. You said that these data were known prior to the year 1907, will you give some authorities to substantiate your statement?

A. I would refer first to the book entitled "The Constructor", by F. Reuleaux, published by D. Van Nostrand Company, in 1893. The general subject of gearing is gone into extensively, beginning on page 127 and continuing to page 150. On page 138 spiral gears are particularly discussed, and the various methods of calculating the angles of the teeth, and number of teeth, and all other problems connected with the designing of these gears is developed quite completely. The carrying capacity of the teeth of gears is also set forth fully in various parts of this section, included in which is the carrying capacity of spiral gears. There is ample information in this one book alone, to have properly designed the gears in question. I may note for instance that on page 140 of The Constructor, under Example 10, the following statement appears to indicate the synonymous use of the terms "worm" and "spiral" gears: "The worm, or endless screw, as already stated, is a form of spiral gear wheel."

Plaintiff's counsel introduces the said treatise in evidence, marked: "Plaintiff's Exhibit No. 25, The Constructor".

Q. 89. Do you recall in your early studies of the subject any treatises or articles giving the necessary information, and which were published prior to the year 1907?

A. The Constructor, that has just been introduced in evidence as Plaintiff's Exhibit No. 25, was one of the books that I studied and was very familiar with about

the year 1900. I also was familiar with and studied numerous articles appearing in the American Machinist and other similar magazines before the year 1907, on the question of spiral gearing. I have here photostatic copies of an article from the American Machinist of January 13, 1898, which I do not remember seeing at the time it appeared but which I subsequently saw in various reprints which have been published. This article is entitled "Modern Practice with Worm Gearing", by F. A. Halsey. I would like to refer in particular to a number of sections of this article, the first being on page 24-20. Near the bottom of the page, in the middle column, it states: "The essential change in practice which has improved the results obtained with worm gearing has been an increase in the pitch over what was formerly considered proper". And, also, near the bottom of the third column on the same page, it states: "The ratio of the lost work to the useful work is therefore reduced by the increase in the thread angle, and since the tendency to heat and wear is the immediate result of the lost work, it follows that that tendency is reduced. For small angles of thread the change is very rapid, and continues, though in diminishing degree, until the angle reaches a value not far from 45 degrees, when the conditions change and the lost work increases faster than the useful work, an increase of the angle of the thread beyond that point reducing the efficiency." On page 21-25, or the second page of this article, there is shown a diagram marked "Fig. 2.—Relation between Thread Angle and Efficiency." This diagram has two curves, the upper one being the efficiency of the gears alone, and the lower one taking into account the efficiency of the thrust bearing. They are very similar, and for our purposes we can consider the upper curve. This shows the maximum efficiency of the gear alone or the worm alone, as occurring at an angle of 43° and 34′;

the curve, however, is almost flat between an angle of 30° and an angle of 60°, showing that a worm of any of these angles could be used with practically equal efficiency. It states, on this same page, near the bottom of the third column, 'Thus, for the upper curve there is scarcely any choice btween 30 and 60 degrees of angle, and but little drop at 20 degrees."

This article was continued in the January 20th number of the American Machinist of 1898, and I refer to page 48-24, near the middle of the first column, where it states: "Mr. Christie has made many successful changes, of which these are typical, and he now uses worms with great freedom and success. His general conclusion is that good worms begin with those having the pitch about equal to the diameter, giving a pitch angle of 17° 15'." In this connection I might call attention to the fact that such an angle would correspond roughly to a ratio of 1:5, set forth by Defendant's expert as being the highest permissible ratio. As a matter of fact, the information and data set forth in this article show that 1:5 is closer to the lowest ratio for the best practice. I observe that Defendant's expert has used both the ratio of 1:5 and 5:1 but I assume that it means the same in both instances, and that he considers 1:1 a higher ratio than 1:5, on which understanding I am now discussing the subject.

This article continues, as follows:

> "Three other cases of successful worms under heavy duty are found in milling machines which have been repeated many times. The first two worms would be ordinarily described as spiral gears. The shafts are at right angles and the action is that of worms, and they are properly included here."
>
> "The first of these, which appears as 14 in the diagram, has a pitch diameter of 2¼ inches, a pitch

angle of 45°, and a speed varying between 180 and 945 r.p.m., giving pitch line velocities of 106 to 555 feet per minute."

I am calling attention to this last paragraph as some writers tend to call a spiral gear with a few teeth, giving a small angle with the plane of the gear or a large angle with the axis, a worm. Here is one having an angle of 45°, which this author calls a worm and which he appreciates some might call spiral gears. That is the finish of that article.

I also wish to refer to another article appearing in the November 14, 1901 issue of the American Machinist, page 1261, entitled "Spiral Gears" by F. A. Halsey. This article in general gives the method of finding the angle of the tooth, the number of teeth, the diameter of the gear, and all the usual information necessary for laying out these gears. I wish to refer particularly to the middle column of page 1262, about the middle of this column, where it says: "In the extreme case of a spiral gear in which the helix angle is so small that the gear becomes a single thread worm, as in Fig. 4, points *o* and *d* coincide and the length of the helix between *a* and *d* becomes the normal pitch."

I should also like to refer to the bottom of page 1262, the same article, where it states:

"Geometrically speaking, there is a wide range of choice in the helix angle. As regards the desirability of different angles from the standpoint of durability, the conditions are essentially the same as in worm gearing. Reference to the article, 'Modern Practice with Worm Gearing', published in the issues of January 13 and 20, 1898, will show that the most favorable angle for durability is 45 degrees. There is, however, but a trifling increase in wear down to 30 degrees, no serious increase down to 20 degrees,

and no destructive increase down to about 12 degrees. Where gears are to transmit considerable power the best result should attend the use of angles between 30 and 45 degrees, while angles as low as 20 degrees may be used without hesitation, and as low as 12 degrees if the gears are to run in an oil bath or do light work only. The angle may also be increased above 45 degrees by similar amounts and with similar results."

These are all of the particular passages which I wish to refer to, but the whole article gives a great deal of information on all the aspects of the problem.

Plaintiff's counsel introduces in evidence the photostatic copies referred to, marked "Plaintiff's Exhibit No. 26, American Machinist Articles".

Q. 90. You have stated that these articles appearing in the American Machinist have been reprinted. Can you give me any instance of such reprinting? Of course, I am not referring to the exact verbiage, and am not asking you to compare the two treatises word for word. It is substance I am after rather than exact form.

A. These articles were reprinted in substance in a book entitled, "Worm and Spiral Gearing", by Frederick A. Halsey, and published by D. Van Nostrand Company, the original edition appearing in 1902. I have a later edition of this, reprinted in 1918, which I know to be substantially the same as the original articles.

Plaintiff's counsel introduces the said treatise in evidence, marked: "Plaintiff's Exhibit No. 27, Worm and Spiral Gearing".

Q. 91. You have stated that Plaintiff's Exhibit No. 27 is a substantial reprint of the articles embodied in Plaintiff's Exhibit No. 26. Do you find, for instance, the

charted efficiency curve, that you have already testified about, in Plaintiff's Exhibit No. 27?

A. Yes. It is contained in this book in the form of a chart, at the back end.

Q. 92. And do you find that same charted efficiency curve, or substantially the same curve, in other standard treatises of later date?

A. Yes, it is printed on page 184 of the American Machinist Gear Book, by Charles H. Logue, published in 1915 by the American Machinist.

Plaintiff's Counsel introduces in evidence the said treatise, marked "Plaintiff's Exhibit No. 28, American Machinist Gear Book".

Q. 93. Referring, for instance, to page 191 of this treatise, Plaintiff's Exhibit No. 28, do you find any statement relating to the limit of pitch angle?

A. Yes. It states that good worms begin with those having a pitch angle of 17° 15', as being the conclusion of Mr. Christie.

Q. 94. Have you examined the spiral gearing in Plaintiff's Exhibit No. 2, and, if so, please compare it with the spiral gearing in the ordinary Goodyear commercial machine.

A. Yes, sir, I have examined the spiral gearing in the State machine, Plaintiff's Exhibit No. 2, and also in the ordinary commercial Goodyear machines in use in the Goodyear factory. I find that these gears are the same.

Q. 95. State whether or not the speeeds are the same in Plaintiff's Exhibit No. 2 as in the Goodyear commercial machine, and, if any, how the difference of speed is obtained.

A. The speeds are different. The machine of Plaintiff's Exhibit No. 2 operates at considerably higher speed. This difference in speed is obtained by changing the spur gears on the rear end of shaft 90 (the core shaft) and shaft 70

(the clutch shaft), these figures referring to the drawings of the patent in suit. The machine of Plaintiff's Exhibit No. 2 has a spur gear on shaft 70 containing 58 teeth, meshing with a gear on shaft 90 having 30 teeth. In the machines in use in the Goodyear factory, these two gears each have 44 teeth which consequently reduces the speed of the core shaft to almost half that of the core shaft in the machine of Plaintiff's Exhibit No. 2.

Q. 96. In other words, then, if I understand you, the lowest speed in the Goodyear commercial machine is not secured by variation in the spiral gearing itself, but rather by changes in the spur gearing between the clutch shaft and the core shaft, is that correct?

A. Yes, that is correct.

Q. 97. In connection with the allegations of impracticability advanced by Defendant's expert, of the spiral gearing, etc., in the State patent in suit, have you endeavored to embody in any working machine or model the spiral gearing of the patent?

A. Yes. I have had constructed a working model of the machine shown in the State patent, to a scale of one-half full size, and have made the proportions of all the gearing the same as that shown in the patent drawings, as near as I could determine them. This machine is a practical operative machine, and tires have been constructed upon it without difficulty.

Q. 98. Are the forms of spiral gearing, etc., embodied in this model, substantially the same as those described by Plaintiff's expert, Mr. Browne, in his *prima facie* deposition?

A. Yes, they are the same.

Q. 99. In this model you refer to, are the fast and low speeds, respectively, mounted in the same position as they are in Plaintiff's Exhibit No. 2 and in the Goodyear commercial machine?

A. No, they are not. They are mounted in the same position shown in the State patent in suit, in accordance with Mr. Browne's explanation of it.

Q. 100. What is the high speed of the core in the model you refer to? Is it 230, as in Plaintiff's Exhibit No. 2, or is it 207, as set forth in the State patent in suit?

A. Neither. It is approximately 293.

Q. 101. Why did you provide a speed of 293, which is so much higher than that presented in Plaintiff's Exhibit No. 2, or in the Goodyear commercial machines, or in the State patent in suit?

A. As this machine is one-half size, I increased the speed of the core so as to keep the effect of centrifugal force the same as that which would occur at the speed set forth in the patent in suit in case of a full size core. In other words, the full size core would operate at 207 in accordance with the patent, and to give the same centrifugal effect on a half size core it would have to operate at 293.

Q. 102. What is the speed ratio in the model you refer to between high speed and low speed?

A. 1:3$4\frac{1}{2}$, which is the same as set forth in the State patent.

Plaintiff's counsel introduces in evidence the model referred to, marked "Plaintiff's Exhibit No. 29, Model of State Machine".

By Mr. Seward: I object to the reception in evidence of this model, as incompetent, immaterial and irrelevant.

Q. 103. You have already referred to the hydraulic bursting tests you employed in connection with the tires, Plaintiff's Exhibits No. 18 and No. 19. What other tests for tires do you know of?

A. I am familiar with the method of testing tires which is commonly called the road test, wherein a very

large number of tires are placed upon test cars and driven to destruction under certain conditions, and a record kept of the behaviour of the tires during this time.

Q. 104. Why did you not employ such a road test in connection with the tires, Plaintiff's Exhibits No. 18 and No. 19?

A. I gave this matter of tests very careful consideration and came to the conclusion that a road test was impractical because it would have required, in my opinion, something like a thousand tires of each variety, as well as from one to two years to conduct. The expense would have run into several hundred thousand dollars, and the time available which I had for conducting these tests was not sufficient to consider it.

Q. 105. Have you, since defendant's expert gave his deposition, visited any of the tire factories which use defendant's machines, for the purpose of observing them in operation?

A. Yes.

Q. 106. Will you state what factories you have thus visited?

A. I have visited the Lee factory, at Conshohocken, Penn.; the Zee-Zee factory, near Trenton, N. J.; the Ajax factory, at Trenton, N. J.; and the Racine factory, at Racine, Wis.

Q. 107. Are these the only factories employing defendant's machines that you have ever visited?

A. Yes.

Q. 108. What was your purpose in making these visits?

A. I wished to observe the means for forming the fabric upon the sides of the core, and the method of using these means practiced commercially by these companies, and see if these methods of using them were the same as the method observed by me in defendant's exhibition of its machine which I observed at Trenton, N. J. I was advised by counsel that defendant's expert in substance

contended that such a mode of use indicated that the machine is an automatic one.

Q. 109. Were these machines that you observed at these four factories substantially similar to the machine that was demonstrated by defendant at Trenton, N. J., in respect of the forming rolls and the operating devices therefor?

A. Yes, they were similar in those respects.

Q. 110. Did you observe the other parts of these machines to any extent? I refer more particularly, by way of illustration, to the fabric supply devices, tension devices, bead-applying devices, and other mechanisms not closely related to the side forming rolls.

A. No, I did not inspect these machines closely in respect to these latter mentioned parts, as I was chiefly interested in the side forming devices.

Q. 111. Do you recall at the exhibition of Defendant's machine that you observed at Trenton prior to the beginning of evidence in this case, how the slide or carriage which supports the forming rolls was advanced during the forming roll operation?

A. Yes, I believe, if my recollection is clear on that matter, the carriage was advanced by the screw which was operated by power.

Q. 112. In other words, at the Trenton demonstration of defendant's machine, the slide or carriage was advanced mechanically and not manually, is that correct?

A. Yes, that is my recollection of it.

Q. 113. And at the four factories which you visited and where you observed defendant's machines in operation, were the slides or carriages advanced mechanically or manually?

By Mr. Seward: Objected to as immaterial, incompetent, irrelevant, and not rebuttal testimony.

A. In the machines which I observed in these four factories, the slide carrying the stitcher arms was ad-

vanced manually in all cases, the operator turning the hand wheel mounted upon the screw which feeds the carriage inward.

Q. 114. Now next state what you observed as to the angle of the forming rolls during the time the rolls were advanced along the sides of the core to form the fabric thereon.

By Mr. Seward: Same objection; and it is agreed that this objection may stand through all further testimony as to these machines, without repetition.

A. These forming rolls stood at a receding angle with the core during the whole time that they were acting upon the fabric upon the sides of the cores. By "receding angle" I mean that the rolls were maintained at an angle relatively to the plane of the core, similar to that shown in Figure 12*b* of the State patent in suit.

Q. 115. During this advance of the rolls along the sides of the core, at the four factories you have mentioned, was the angle of the roll changed with respect to the plane of the core, and, if so, when?

A. No the angle was not changed during the advance of the rolls upon the side of the core. After the bead was placed on top of the one or two plies first laid upon the core, and the fabric which goes outside of the bead formed down to the inner edge of the bead, then the angle of the rolls was changed so as to form the fabric under the bead or on the bottom side of the bead, but it was not changed during the forming of the fabric upon the sides of the carcass.

Q. 116. And this was true of all four of the factories you mentioned?

A. Yes.

Q. 117. Next, with reference to the means employed for pressing or forcing the rolls against the side of the core during their inward or forming movement, what

means and method were employed at the four factories you have mentioned?

A. There were two different methods employed in these factories, both in turn being different from the method I observed during the exhibition of defendant's machine.

Q. 118. Will you specify the different methods you have referred to in your last answer?

A. In the Lee factory the machines were equipped with weights which pull these forming rolls against the sides of the core, but the pressure which they exerted upon the core was controlled by the operator manually by operating the hand wheel, which in turn through a worm controls the horizontal disk, which in turn through connecting rods controls the movement of the stitcher arms; these connecting rods were made fast to this disk so that the position of the stitcher arms and consequently the position of the forming rolls was under control of the man operating this hand wheel; he so operated it that the forming rolls were in contact with the fabric upon the sides of the core during the inward travel of these rolls, but it was impossible to determine just what pressure was being exerted by the rolls against the core; that is, I could not tell whether the whole of the pressure exerted by the weights was being used, or whether only a part of it, or whether, even, he was adding to the pressure of the weights.

The same mode of operation exactly was followed in the Zee Zee factory, and in the Ajax factory.

In the Racine factory, the weights had been removed and the stitcher arms were pressed against the sides of the core by means of springs which were interposed between the horizontal disk and the outer ends of the stitcher arms. In operation, the operator controlled the pressure on these springs by turning the hand wheel which, through the worm, controls the horizontal disk. The whole pressure, however, of the forming rolls against

the sides of the core was due to the compression of these springs.

Q. 119. Did you observe in these four different factories, the fabric as it was being laid upon the side of the core?

A. Yes, I did.

Q. 120. And did you note carefully the condition of that fabric as it was being laid upon the side of the core?

A. Yes.

Q. 121. Will you state whether or not you observed the fabric sufficiently well to determine whether or not the reticulations of the fabric had been changed so as to show diamonds with their long axes radial?

A. Yes, I did. I paid particular attention to this point.

Q. 122. And you actually saw in each of these four factories, diamonds in the fabric, in or near the bead portion, with their long dimension radial, is that correct?

A. Yes, that is correct.

Q. 123. Will you state whether or not you have observed a similar phenomenon in connection with the Goodyear commercial machines at Akron?

A. Yes, I have observed the same phenomenon, and have observed the diamonds in the bead portion of the tire with the long axes radial, many times.

Q. 124. Were these radial diamonds, that you saw in the fabric in the four factories using defendant's machines, readily perceptible?

A. Yes, these diamonds were readily perceptible in all cases. In some of the factories where the friction coating was dark, it could only be seen where this was knocked off by the stitcher rolls; but in the Ajax and the Racine factories, the friction coating was quite transparent and it was very easy to see the diamonds there at all points.

Q. 125. Now, will you state whether or not you have purchased the actual commercial tires of the four con-

cerns using defendant's machines you have already referred to?

A. Yes, I have purchased one each of these tires, namely, the Lee, Zee Zee, Ajax, and Racine.

Q. 126. How did you purchase these tires?

A. I purchased them in New York City from their regular retail branches here, with the exception of the Zee Zee tire which I purchased from an ordinary retail dealer on Broadway.

Q. 127. And are these tires marked with some name to indicate the concern that manufactures them?

A. Yes, they all bear the manufacturer's name.

Q. 128. Will you kindly produce the four tires named?

A. I here produce them.

Plaintiff's counsel introduces the four tires in evidence, marked, respectively, "Plaintiff's Exhibit No. 30, Ajax Tire"; "Plaintiff's Exhibit No. 31, Lee Tire"; "Plaintiff's Exhibit No. 32, Zee Zee Tire"; "Plaintiff's Exhibit No. 33, Racine Tire".

By Mr. Seward: Same objection as to last exhibit, and it is agreed that this objection may stand against all testimony with reference to these exhibits, without repetition.

Q. 129. Will you examine the four tires, Plaintiff's Exhibits No. 30, No. 31, No. 32, and No. 33, and state whether or not you find therein diamonds with their long dimension radial in or near the bead portion?

A. I have examined these tires and find that there are diamonds present in the bead portions of all four tires, with their long axes radial. Certain portions of the outer covering and some portions of the layers of fabric have been loosened or removed from these tires so that the inside fabric is visible.

Q. 130. Are there any markings on the fabric in these

four tires to assist in showing the diamond formation you have referred to?

A. Yes, certain of the threads have been outlined with black pencil so that larger diamonds in black lines appear on the fabric.

Q. 131. What do you mean by "larger diamonds"?

A. I mean diamonds containing a number of threads within their boundaries in each direction.

Q. 132. That is to say, you mean that each of the larger diamonds that are indicated in black pencil comprise a number of smaller actual diamonds?

A. That is correct.

Q. 133. And in this way you make the angularity of the diamonds more appreciable to the eye, is that correct?

A. Yes.

Q. 134. Will you state whether or not you have had made a tire relying largely or entirely on circumferential stretch to secure the formation of the fabric to the core?

A. Yes, I had such a tire made under my direction in the Goodyear plant.

Q. 135. Are you able to produce this tire?

A. Yes, and I herewith produce it.

Plaintiff's counsel introduces the tire in evidence, marked "Plaintiff's Exhibit No. 34, Tire Made by Circumferential Stretch".

By Mr. Seward: Same objection, and it is agreed that it may stand without repetition against all testimony in relation to this tire.

Q. 136. Do I understand that in this tire you relied entirely on circumferential stretch, and that no radial stretch was employed?

A. Yes, that is correct. The forming of the fabric was done entirely by circumferential stretch. There were no tools used to form it on the sides, the plies simply

being cemented together, pressed together, by use of the fingers, on the undercut part of the core.

Q. 137. Have you cut open the rubber cover so as to expose the under fabric in this tire, Plaintiff's Exhibit No. 34?

A. Yes, I have done so in several places.

Q. 138. And do you find diamonds in the bead portion of this tire, Plaintiff's Exhibit No. 34?

A. No, there are squares in the bead portion.

Q. 139. Are there any diamonds at all in the fabric of this exhibit tire?

A. There are no diamonds with their long axes radial, but on the sides of the tire there are diamonds with their long axes circumferential, which become more pronounced toward the center of the tread portion of the tire where they are at maximum.

Direct-examination closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 140. When you saw Mr. Mackey make his tires by hand-spinning, who placed the beads?

A. Mr. Mackey placed most of the beads. Mr. Shaw, I think, assisted him in a few cases.

x-Q. 141. When you say Mr. Shaw assisted him, do you mean that the two of them placed some of the beads together, or do you mean that Mr. Shaw placed some of the beads all by himself?

A. I mean that Mr. Shaw placed a few of the beads on by himself, to hurry along the work.

x-Q. 142. Did you help Mr. Mackey at any time in the making of these tires?

A. I would hardly say that I helped him. I observed him mostly. I may have assisted him in measuring the thickness of the plies a few times,—practically no help whatever on my part.

569

x-Q. 143. Did you help him at any time in stretching the fabric on the core?

A. I may have put my hand on the core once or twice to steady it on the stand,—in fact I think I did.

x-Q. 144. What do you mean by "steady it"?

A. Well, it was rather difficult in getting the end of the fabric to hold onto the core. That is, in starting the ply he would attach the end of the strip of fabric to the core, and as he did not want to have any more of the fabric than possible sticking to the core, at times when he pulled it, it would pull loose at the end, and I think I placed my hand on top of it so as to steady the core, and I may have helped to prevent the core from rotating slightly by doing that.

x-Q. 145. Did anybody else assist Mr. Mackey?

A. I believe Mr. Shaw put his hand on the end of the fabric once or twice in the same way, but that is the only assistance that Mr. Mackey was given in either applying the fabric or stretching it on, or in spinning it down.

x-Q. 146. Did the core he used have a pawl and ratchet or some other device for holding it against rotation while the fabric was being stretched circumferentially?

A. No, the core was mounted upon a spider which rotated on ball bearings on the core stand. Mr. Mackey prevented it from rotating while stretching the fabric on, by leaning his apron and his leg against the core.

x-Q. 147. And there was no other means for preventing the core from rotating while the fabric was being stretched circumferentially?

A. None, whatever.

x-Q. 148. Did you analyze the rubber used for the cover of these tires, or test it in any way?

A. No. This was the standard stock with the standard friction coating, used by the Goodyear Company.

x-Q. 149. How can you say that it was standard?

A. I instructed Mr. Shaw to obtain the standard stock, and I was informed that it was the standard stock; and, furthermore, it appeared to be the same as the standard stock which I have seen used from time to time, and I know from my knowledge of the factory and the methods which they use in producing this, that it would be very difficult to obtain anything else, so that I have every reason to believe that it was the standard stock.

x-Q. 150. Then you believe this was the standard stock used for the cover or cushion of the regular Goodyear tires?

A. Yes, I firmly believe that.

x-Q. 151. You do not believe, do you, that it was the standard stock used for the tread of the regular Goodyear tires?

A. No, there was no tread applied to these tires.

x-Q. 152. Do you know whether or not there is a difference between the cover or cushion stock and the tread stock which is used as standard by the Goodyear Company?

A. I do not know from my own knowledge, that is from analysis, or anything of that kind. I have understood that there was a difference.

x-Q. 153. And you believe there is a very marked difference, do you not, in the compositions used for these two purposes?

A. I believe so.

x-Q. 154. I understand you to say that the apparatus you used in testing these tires made by Mr. Mackey and Mr. Shaw, embodied in Exhibits No. 18 and No. 19, was specially made for that purpose?

A. Yes. The apparatus was specially made for this purpose.

x-Q. 155. Who designed that apparatus?

A. It was my suggestion that it should be made, but the particular proportions of the rim were laid out by

some of the Goodyear designers, and then later the bull-ring was constructed at my request and substantially as I directed them. The general arrangement of the apparatus was about as I had directed them to prepare it.

x-Q. 156. Is it correct to say that you designed the form of the apparatus and its elements, except as to their particular dimensions?

A. I think that will be substantially correct.

x-Q. 157. Where did you obtain your ideas for this design?

A. Well, I have been long familiar with bursting tests in connection with machinery in general,—possibly from that familiarity,—it might have suggested the possibility of conducting these tests. I am not just certain, of course, what suggested the idea to me, except that the whole idea of the tests came as a result of my study of the stresses in these tires under internal pressure.

x-Q. 158. Did the Goodyear Company, so far as you know, have apparatus for conducting this test?

A. I do not know just what apparatus they did have available.

x-Q. 159. Did you not say that you know they do use such a test for the tires?

A. That is true, but I do not know all the apparatus they have. They use their rims,—such for instance as they use for vulcanizing,—they have used such rims for testing, and I did not investigate to see just what they did have.

x-Q. 160. Why did you not investigate and determine and use the apparatus employed by the Goodyear Company for this purpose, instead of designing your own apparatus?

A. At the time I suggested making these tests I did not know anything about any previous tests the Goodyear Company had made in these lines, so it naturally

did not occur to me to see what apparatus they might have.

x-Q. 161. Did you ever see the Goodyear Company make such a test?

A. No, I have not seen them make the tests themselves. I have seen a number of tires being made for these tests, and I have discussed with the engineers the results of these tests afterwards, and I have given certain formulas by which it is possible to calculate the stresses in tires, and these tests have been conducted partly to verify these formulas; so that I have been quite familiar with the work they were doing, although I did not happen to be out there when they were conducting the tests.

x-Q. 162. So far as you know, did the Goodyear Company use such a test before you made the tests on these exhibits?

A. I only know from statements made to me by Goodyear engineers and men who have conducted these tests. They stated that they had done it in the past.

x-Q. 163. Then this kind of testing was not applied by the Goodyear Company as a result of your advice or suggestion?

A. No, not at all. The tests which I speak of as being quite familiar with, were started by engineers connected with the designing of tires; before I heard of them they had been started and the tires were under construction, so I do not believe that it was due to my work that it was started.

x-Q. 164. As I understand, you did not hear of such tests by the Goodyear Company until after you had made the tests on these exhibit tires, is that correct?

A. No, I had heard of it before I actually made the tests, but after I had started to do so.

x-Q. 165. How far along were you in the tests on the exhibit tires when you heard of this?

A. The first time I recollect hearing about the Good-

year Company conducting such tests was, I think, about last November, when I went out to the Goodyear plant under the impression that my apparatus was ready (which I found however not to be the case), and upon that occasion I then heard of Goodyear having previously done work on these lines.

x-Q. 166. Mackey and Shaw did not make these tires until May of 1920, did they?

A. That is correct.

x-Q. 167. Did you ever see the apparatus the Goodyear Company has used for such hydraulic tests?

A. No.

x-Q. 168. Then you do not know how it compares with the apparatus you employed in testing these exhibit tires?

A. Yes, I think I do know, because of my familiarity with the general subject,—the apparatus was exactly similar in fact.

x-Q. 169. Was there any difference?

A. No difference in anything except mere details.

x-Q. 170. What were those details?

A. Different rims were used.

x-Q. 171. By "rim" you refer to the part which you have marked on your sketch of this apparatus marked "Rim in Halves"?

A. Yes, and I also refer to the bull-ring as being different.

x-Q. 172. How did the bull-ring differ?

A. In these particular tests that I refer to, no bull-ring was used whatever.

x-Q. 173. No bull-ring was used by the Goodyear Company?

A. By the Goodyear Company,—due to the fact that they were able to get along without it.

x-Q. 174. When tires are in position on the rim of a vehicle for use, no bull-rings are employed, are there?

A. No. It is not necessary in that case, as the pressure is so low.

x-Q. 175. Who mounted these exhibit tires on the apparatus for the tests?

A. Mr. Shaw and Mr. Johnson.

x-Q. 176. You were present when they were mounted?

A. Yes, I was.

x-Q. 177. Who else was present?

A. There were a number of different people present at different times. Mr. Trogner was there at times, and possibly a number of other workmen in the factory; and in addition, a Mr. W. C. Lincoln was present, took the readings with me but independently of me, so as to if necessary corroborate my results.

x-Q. 178. Is Mr. Lincoln an employee of the Goodyear Company?

A. Yes, he is.

x-Q. 179. Who operated the needle valve in the tests?

A. I did most of the time, but sometimes Mr. Lincoln did.

x-Q. 180. Did you read the gage during the times when you operated the needle valve?

A. I read the gage at all times, both when I operated it and when Mr. Lincoln operated it, and he did likewise.

x-Q. 181. How large was the gage in diameter?

A. The gage was a twelve inch Crosby test gage graduated to 600 pounds, in two pound divisions, and which was purchased by me for this purpose. Single pounds can be readily read from the gage.

x-Q. 182. I understand you mean it reads from zero to 600 pounds, in two pound divisions?

A. That is correct.

x-Q. 183. What is the purpose of the valve immediately adjacent the gage?

A. That is simply a valve which is used to shut the

gage off when not in use, so as to avoid the danger of the whole 1500 pounds pressure going on it and ruining it.

x-Q. 184. Did you operate that valve at any time?

A. Yes. I, of course, opened it at the beginning of the test and I saw that it was open all the time, and I closed it off at night when we got through; and I opened the waste valve, which is shown on the sketch, to avoid any possibility of injuring the gage.

x-Q. 185. Did anybody else operate either of these two valves?

A. Not during the testing of these tires.

x-Q. 186. What do you mean by "during the testing"?

A. Well, I mean during the actual taking of the readings. Mr. Shaw may have opened them in the first place to let the tire fill with water, but in the majority of cases I also did this.

x-Q. 187. Was this valve adjacent the gage shut off after the testing of each tire?

A. No, only at nights, and when we finished with the test. We took care to open the waste valve, which in itself would prevent any pressure acting on the gage.

x-Q. 188. Was the waste valve opened after the testing of each tire?

A. Yes, as a rule it was.

x-Q. 189. Who did that?

A. I did in the majority of cases. Mr. Lincoln may have sometimes.

x-Q. 190. Who closed this waste valve at the beginning of the test of each tire?

A. Either Mr. Lincoln or myself,—I usually.

x-Q. 191. Who connected the hydraulic hose to the tire?

A. Mr. Shaw and Mr. Johnson would do that.

x-Q. 192. I understand that these half rims of this device were held in position by the bolts shown?

A. Yes, they were held together by the bolts, but you

note there is an offset joint there which keeps their axes the same.

x-Q. 193. Who fastened these bolts at the time each one of these exhibit tires was placed on the apparatus for test?

A. Mr. Shaw and Mr. Johnson did that.

x-Q. 194. What kind of inner tubes were used in these tests?

A. These were standard Goodyear inner tubes, known, I believe, as heavy tourist's tubes, with the spreader removed from the valve stem. By the spreader I mean a kind of oblong washer which prevents the inner tube from blowing out around the valve stem in the ordinary use of the tube. This washer is held onto the stem by means of a nut. We had to remove this, because it is in the form of an arch and it keeps the inner tube away from the rim. Under this extremely heavy pressure, the inner tube would blow out around this spreader, so we found that we had to use instead a circular washer which fitted in the recess in the bull-ring so that the supporting surface of the inner tube would be practically smooth. The valve was also removed from the valve stem.

x-Q. 195. Did you use a different tube for testing each tire?

A. Yes. The tube blew out when the tire burst in each case.

x-Q. 196. And in no case was a tube repaired and used again?

A. No, in no case.

x-Q. 197. So you used twenty-two different inner tubes in this test?

A. Yes, we did.

x-Q. 198. About how long did it take the pressure within the tires to rise from the preliminary pressure of 100 pounds or so to the average bursting pressure?

A. Oh, approximately, three minutes or so. We would

start off more rapidly and when we reached about 300 pounds we would slow it down so that the pointer of the gage would pass over a pound division in from a half to a second perhaps, so that we could readily count each pound as it went up,—slow in fact, the counting was.

x-Q. 199. Were the figures you have given the exact readings of the gage?

A. They were the exact readings when the tire gave way. It was very easy to get these, as the pointer would usually remain steady for a few seconds just on the bursting point; that was due to the fabric gradually giving way and the tire enlarging slightly at that point, and then it would suddenly burst, and then go back; so that it was very easy to practically get exact readings, that is, I mean within a pound.

x-Q. 200. What happened to the gage when the tire burst?

A. The pointer would come back fairly quickly, within half a second maybe.

x-Q. 201. Was there a lot of noise when the tires burst?

A. Yes, there was, due to the presence of some air in them.

x-Q. 202. Did the tires burst in the part which you have referred to, or which Mr. Browne has referred to, and indicated on exhibits as "Tread Zone", in every case?

A. Yes, they burst in this zone. Whether the tear covered the whole of this zone in every case or not, I am not certain.

x-Q. 203. How long was the flexible hydraulic hose?

A. About ten feet.

x-Q. 204. And about how long do you say the pointer of the gage remained stationary immediately prior to the bursting?

A. As a rule, a few seconds. Perhaps in some cases a second or even less.

x-Q. 205. Was the bull-ring endless?

A. Yes.

x-Q. 206. And made of metal?

A. Yes, of steel.

x-Q. 207. And the divided rim was also of metal?

A. Yes.

x-Q. 208. Did you ever see hose being tested with hydraulic pressure at the Goodyear plant?

A. No.

x-Q. 209. Did I understand you to say that about 80 pounds air pressure would be the ordinary pressure used in tires of the size of these exhibit tires when on a vehicle?

A. I stated that they were inflated to 75 pounds.

x-Q. 210. That would be about the ordinary pressure to which they would be inflated on automobiles?

A. That is the proper pressure.

x-Q. 211. Describe the experiments which you made to devise means to hold the beads on the tires in position during the tests.

A. We attempted to conduct preliminary tests with this ring, as shown in my sketch, without using the bull-ring, but found that the beads would not hold. That is, they would break and the inner tube would blow out along the rim before the fabric of the tire would give way. We started this way because some of the engineeers of the Goodyear Company were under the impression that the beads would hold; but after a good many attempts in which we had a great deal of difficulty, not only with the beads giving way but with the inner tubes themselves blowing out inside of the casing, owing probably to the expansion of the casing itself under this high pressure, and the consequent stretching of the inner tube at the point between the casing and the rim, we decided that it would be necessary to hold the beads in some manner and I suggested the making ot a ring of this type.

x-Q. 212. Was this difficulty which you experienced with the beads giving way or the inner tube blowing out, a thing that occurred before or after Mackey made his tires?

A. That was before Mr. Mackey made his tires.

x-Q. 213. How long before?

A. The fall of last year.

x-Q. 214. When you met with this difficulty, why did you not proceed to use the apparatus employed by the Goodyear Company for such tests?

A. It never occurred to me, and no one connected with the Company suggested it, so we simply proceeded along the lines which we had started.

x-Q. 215. So far as you know, when the Goodyear Company used a hydraulic test did they burst the tires being tested?

A. I so understood that they did. In fact, that was the object of their test.

x-Q. 216. Do you know whether or not the Goodyear Company employs a road test on vehicles, in testing its tires?

A. Yes, they do.

x-Q. 217. Do you know of any other tests employed by the Goodyear Company?

A. Well, they have a great many tests connected with the tires,—various portions of the tires, all of these various tests being for the purpose of determining some particular feature.

x-Q. 218. I mean some other test of finished tire or carcass, as distinguished from the elements.

A. I am not certain that at the present time they are giving their finished tires any other commercial tests than the road test. They go very extensively into this latter method of testing, using I understand from 500 to 5,000 tires of any particular size in approximately two years' time before they consider the test completed.

x-Q. 219. Can you explain why they go to that ex-

pense and incur that delay, if the test to which you put these exhibit tires gives more accurate results when only ten or twelve tires of each kind are employed?

A. Yes. In testing the finished tire there are a great many other points under investigation besides the carcass itself. There is the wearing quality of the tread, the separation of the tread, the separation of the cushion, the breaker strip, the side walls, the question of rim cutting, and possibly many other points which are necessary to know about the completed commercial tire but which are not involved in the question which I attempted to determine.

x-Q. 220. What was the question you attempted to determine?

A. I attempted to determine whether or not the stresses set up in a hand-made tire were greater than those set up in a machine-made tire, under exactly similar conditions of loading.

x-Q. 221. In the commercial test of the tires to which you have referred, is the question of unity of beads with the carcass involved?

A. Yes, certainly.

x-Q. 222. Is the question of buckles in the fabric involved?

A. Buckles would undoubtedly be shown up in the commercial test.

x-Q. 223. Is the question of separation of plies of fabric involved?

A. Yes.

x-Q. 224. Is the question of accuracy, or formation, size and placement of the beads involved?

A. Well, in a way, I should say. Of course, that is easily determined by other methods.

x-Q. 225. What other methods?

A. Simple measurements, or fitting on of the rims, is all that is necessary to determine that.

x-Q. 226. They are fitted on the rim when they are put on the vehicles for road test, aren't they?

A. Yes.

x-Q. 227. Were these beads employed in the exhibit tires made by Mackey and Shaw, metal beads?

A. They have piano wire reinforcements inside surrounded by fabric.

x-Q. 228. Are they inextensible?

A. Yes, practically so.

x-Q. 229. Are they very strong?

A. Yes, I should so call them.

x-Q. 230. You referred to some previous test you made on three hand-spun tires and four machine-made tires, all made by Mr. Shaw. Will you please give me the bursting pressure of each of those tires?

A. Yes. In my previous statement concerning these tires, I made a mistake, in that the second machine-made tire was not made by Mr. Shaw but was one that was taken from stock and was made in the regular production in the Goodyear plant, as far as I know.

Machine-made tires: 448, 450, 390, 440; average, 429.5.

Hand-made tires: 390, 373, 388; average, 383.6.

x-Q. 231. By "the second machine-made tire" just mentioned, you refer to the one which burst at 450 pounds?

A. That is correct

x-Q. 232. Did you see Mr. Shaw make three of the machine tires, and the hand-made tires?

A. Yes. Although I was not present every minute of the time.

x-Q. 233. Where did he make the hand-made tires?

A. He made them at 34 Barclay Street; and also the machine-made tires there.

x-Q. 234. Did he make those machine-made tires last spring?

A. No. They were all made, both the machine- and hand-made tires, about September 15th, last year.

x-Q. 235. Was the machine, Exhibit No. 2, driven by electric power when those machine-made tires were made?

A. Yes, it was.

x-Q. 236. When you said "34 Barclay Street" did you mean here in New York City?

A. Yes.

x-Q. 237. Do you mean to say that the State patent in suit refers in the specification to either of the parts 76 or 82, as a spiral gear?

A. Yes, I would say so, indirectly, a worm being nothing but a spiral gear.

x-Q. 238. But do you mean to say that the specification of the said patent anywhere calls either of those elements a spiral gear in so many words?

A. No.

x-Q. 239. Please identify the edition, the publisher, and date of publication, of the Standard Dictionary to which you referred.

A. I refer to the edition of the Standard Dictionary published by Funk & Wagnalls Company, of New York, and dated and copyrighted 1913.

x-Q. 240. In the State patent the gears 75 and 83 are shown of the same diameter, are they not?

A. Yes, they appear to be.

x-Q. 241. They are shown as having similar teeth, are they not?

A. No, I would not say so, inasmuch as the teeth of the gear 83 are not shown.

x-Q. 242. Please look at Figure 3 of the drawing of the State patent and say whether or not a side view of a tooth of each of the gears 75 and 83 is shown.

A. Yes. A side view of each is shown, but that is not a sufficient showing to say that the teeth are the same.

x-Q. 243. Does that figure show any difference in the teeth on the two said gears?

A. No, there is no apparent difference in those views.

x-Q. 244. When you said that the power necessary for driving a State machine at a core speed of 207 R. P. M. was not over 2 H. P., on what did you base your statement?

A. On electrical measurements which were made at 34 Barclay Street, New York City, at my direction.

x-Q. 245. Was there any fabric on the core when these measurements were made?

A. No, I believe not.

x-Q. 246. Did you make the measurements yourself?

A. No, I had an electrical contractor do it in connection with installing a rheostat for controlling the speed.

x-Q. 247. Were the spinning rolls in contact with the core when these tests were made?

A. No, I think not.

x-Q. 248. Were these tests made when the machine was first installed at 34 Barclay Street?

A. No. It was some time afterwards. It was a considerable length of time before we were able to get the current, and we had so much difficulty in controlling the speed that I employed an electrical contractor to make these measurements and to install this rheostat to get the thing going properly so that we could make use of the machine.

x-Q. 249. Did he do this?

A. Yes.

x-Q. 250. I understood you to say that in your opinion any designer of ordinary skill could, within the proportions shown in the State patent in suit, easily lay out a worm and gear to occupy the places of the elements 82

and 83 in which the gear corresponding in position to 83 would be driven at a higher rate of speed than its worm. Is that correct?

A. Yes. That is my opinion, based upon calculations which I have made, which are sufficiently simple so that any designer who is familiar with trigonometry could have made the same calculations.

x-Q. 251. In using the expression "lay out" do you mean to include illustrate or draw such gearing?

A. I mean to design such gearing; and by design I mean to give all the necessary information so that such gearing could be built by any machine shop having the usual equipment necessary to do this work. In making such a design it is not necessary for the designer to lay out the tooth forms, as these are absolutely standard and have been for a great many years. However, any ordinary designer who is laying out gears could easily lay out the tooth forms if he so desired, but this is never done, it simply being necessary to give the pitch diameter and width of face of gear, size of tooth, the angle of tooth, and number of teeth in the gear. The drawings ordinarily made by designers are mostly concerned with other details of the gears; for instance, the hub diameter and bore, the number and size of arms, and it is very seldom that any data is given as to the teeth, at the most simply specifying the form of tooth,—that is, whether an involute or some other form of tooth is to be used. This need not of necessity be given, as the involute tooth for such work is so standard and well known that it would be used without doubt if nothing were specified concerning the particular type of tooth.

x-Q. 252. How about the spiral form of tooth, would that be given?

A. There is nothing to the spiral form of tooth to be given. When the angle of the tooth is given, and the pitch diameter, and the size of the tooth, then there is

only one form which it can take and that it automatically takes when it is cut upon the milling machine.

x-Q. 253. Do you say that any ordinary designer could draw that form easily, and without experiment?

A. He could do so if he desired, but in practical drawings it never is done nowadays and has not been done for years and years, except in the case where cast gears are made which used to be the old practice, or when gears with wooden teeth are used, which is also an old practice. In those cases it was formerly customary for the designer to actually design the particular teeth, but since gear cutting has come into practice there is no need for any designer to design the teeth, because this was done once for all by Brown & Sharpe in the ordinary system of teeth; they really design the teeth when they make the milling cutters which cut them; and in using those cutters it is impossible to make any other tooth than the particular one which those cutters are designed to make. So it is simply a matter nowadays for the machine designer to specify those quantities which I have already mentioned,—Brown & Sharpe do the rest.

x-Q. 253. What I intended to ask you was whether or not, in your opinion, any machine designer of ordinary experience could easily draw the spiral of the teeth on the gearing under consideration?

A. Yes, he could easily do this, but of course it would take him a certain length of time; there is more or less detail work connected with it, but the knowledge as to how to do it is well known, has long been published, and anyone with ordinary ability can easily follow it; it is simply a proposition of laying out a helix.

x-Q. 254. Would it require a great deal of work?

A. It would require a considerable amount of work.

x-Q. 255. Even for such a successful designer as yourself, is that correct?

A. I would not consider it a very difficult job and one that would take a very great deal of work.

x-Q. 256. Would it require a great deal of work?

A. No, I do not think so, on giving it consideration. I may have stated in my former deposition that it would require a great deal of work, but I think I will modify that by saying that it would not be extremely difficult, it would not require a great deal of work.

x-Q. 257. Would the driving spiral gear in such an arrangement be an endless screw?

A. Yes, just as much as any screw can be endless.

x-Q. 258. In one of the articles by Mr. Halsey to which you have referred, you have quoted something in which I understood him to intimate that a tooth angle of less than 12° would be a "destructive" degree. Is my understanding correct?

A. The quotation says that "no destructive increase down to about 12 degrees". He says that gears may be used without hesitation "* * * as low as 12 degrees if the gears are to run in an oil bath or do light work only".

x-Q. 259. What do you understand he means by "no destructive increase",—destructive of what?

A. Destructive of the surface of the gear, due to wear. I think that he refers to continuous use.

x-Q. 260. And you think that would not be destructive in intermittent use?

A. It would, of course, be very much less so, depending upon the time of use.

x-Q. 261. By 12° does he mean 12° to the axis of the gear?

A. No, he is measuring his angle from a plane perpendicular to the axis.

x-Q. 262. Can you tell me about what is the said degree of angularity of the teeth on the worm 76 in the State patent in suit, I mean measured with respect to a plane perpendicular to the axis of the said worm?

A. It looks something like 10 or 12 degrees,—of course I do not consider this a working drawing.

x-Q. 263. Do you say that this machine model, Plaintiff's Exhibit No. 29, is an exact reproduction of the machine shown in the State patent in suit?

A. No, it is not an exact rerpoduction of all parts of the patent in suit. For instance, the stock rack has been simplified so as to take but one roll of fabric, as there seemed to be no reason to go to the expense and complication of simply duplicating these various stock rolls, as shown in the patent. The model I consider to be a very good illustration of the patent reduced to metal, and as far as important details are concerned it is about as near a copy of the patent as it is possible to make, in view of the fact that the patent drawings are not working drawings and have no dimensions.

x-Q. 264. Then this model, except for the stock rack, was as close a represenation of the machine shown in the patent as you were able to make?

A. I think that would be substantially true, particularly as to the relation of the various parts and their general mode of operation. Some minor details are undoubtedly different from those shown in the patent, but the machine I think illustrates the general principles set forth in the patent very well.

x-Q. 265. How about the mechanical construction of the various parts?

A. They may differ in some of the details, which I take to be merely illustrative in the patent.

x-Q. 266. Did you try to make this model as close a reproduction of the machine of the patent in suit, mechanically, as you could, except for the stock roll support?

A. I tried to make the gearing a close copy of the patent in suit, and the slide and turret for carrying the

tools, and the tools themselves, but as to minor details, such as the bed plate and various castings, I did not believe that they were points of issue and they undoubtedly differ in some of their details from those shown in the patent in suit.

x-Q. 267. I understand that in this model you increased the high speed of the core so as to increase the centrifugal force acting upon the fabric thereon, is that correct?

A. I increased the speed of the core so as to keep the centrifugal force acting upon the fabric the same as that which would act upon a full size core operating at a speed of 207, as set forth in the patent in suit.

x-Q. 268. What do you mean by a "full size core"?

A. In this case, this would correspond to a 36 inch tire, full size.

x-Q. 269. So that the core on this model is 18 inches in diameter?

A. It represents an 18 inch tire. Yes.

x-Q. 270. What is the law of centrifugal force with respect to the radius of the object being rotated?

A. The law is that it varies inversely as the radius but directly as the square of the peripheral velocity. It can be expressed in the formula: Centrifugal force equals $\frac{m\,v}{r}$, where m is the mass of the particle, v its velocity, and r the distance from the center to the particle.

x-Q. 271. Can you state about what would be the percentage of difference in centrifugal force acting upon fabric applied in the one case to the periphery of a 28 inch diameter core, and in the other case to the periphery of a 36 inch diameter core, both cores rotating at 207 R.P.M.?

A. It is in the proportion of 36:28, which is equivalent to 28 per cent. greater centrifugal force in the case of the 36 inch core, than in the case of the 28 inch core.

x-Q. 272. Then is it generally correct to state that in instances of this kind, the centrifugal force varies inversely as the diameter of the cores?

A. When the speed of rotation is kept constant.

x-Q. 273. What is the low speed of core rotation in this exhibit model?

A. Approximately 8½ R.P.M.

x-Q. 274. Who was with you when you visited the factory of the Lee Tire & Rubber Company that you mentioned?

A. Mr. Luther E. Morrison.

x-Q. 275. Was anyone connected with the Lee Company with you?

A. One of the employees showed us through the factory, a Mr. Weller,—I believe that was his name.

x-Q. 276. Did you see any of the officers or managers of the Company at that time?

A. No, I did not.

x-Q. 277. To whom did you apply for permission to go through?

A. I had a letter of introduction, but I have forgotten the party who wrote it except that he was a representative of the Lee Company, and I presented that letter to a young lady in the office and Mr. Weller took us in tow and showed us through.

x-Q. 278. Who was with you when you visited the Zee Zee factory?

A. Mr. Luther E. Morrison.

x-Q. 279. Any representative with you when you visited that factory?

A. No, I believe we were shown through by the superintendent and we were introduced to Mr. Zimmerman, who I believe is an officer of the Company.

x-Q. 280. Did you use the same letter of introduction?

A. No, I did not have a letter of introduction.

x-Q. 281. Who was with you at the Ajax plant?

A. Mr. Murray, of the Empire Rubber Company, was with me.

x-Q. 282. Were any officers or managers of the Ajax Company with you?

A. Some gentleman connected with the Company, whose name I did not catch, showed us through. He appeared to be the man in charge.

x-Q. 283. Does the name Destribats renew your recollection?

A. That might have been it but I could not swear to that.

x-Q. 284. Did he have a beard?

A. I do not know. I think he was a Frenchman and that might have been his name,—it was a peculiar name and I could not quite catch it.

x-Q. 285. Who was with you at the plant of the Racine Company?

A. Mr. Harry Miller, of the Goodyear Company, was with me.

x-Q. 286. And did you meet any officer or manager of the Racine Company?

A. Yes, I met a number of people there. Mr. Tyler showed us through, and I was introduced to the superintendent, whose name I have forgotten for the moment. I cannot remember these names. I am sorry. I might mention that we visited the Racine factory more or less in connection with another piece of patent litigation, and these facts which I have testified to in connection with this case were somewhat incidental.

x-Q. 287. Were you acting for the Racine Company in this other case?

A. Not at all,—for the Goodyear Company.

x-Q. 288. When was it, about, that you visited each of these four factories?

A. I visited the Lee Factory on February 10, 1920;

the Zee Zee factory on April 5, 1920; the Ajax factory on July 15, 1920; and the Racine factory on July 27, 1920.

x-Q. 289. If the gear 83 of the State patent in suit has 45 teeth, how many teeth would have to be on the worm 82 in order to drive 83 at a higher rotative speed than 82?

A. There would have to be more teeth on the gear 82 to drive the gear 83 at a higher speed.

x-Q. 290. That is, more than 45?

A. Yes. Of course there is nothing shown to indicate that the gear 83 has 45 teeth.

x-Q. 291. Does the patent show any difference in size or dimensions between the gears 83 and 75, including the shape and dimensions of the teeth?

A. The patent drawings give no information as to the number of teeth on the gear 83, consequently I can see no way of comparing the number of teeth on the gear 83 to the number of teeth on the gear 75, but I consider this an immaterial point because it is possible to design the gear 83 with more than 45 teeth and do the required work.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 292. You have stated on cross-examination that the gears 76 and 82 are not called spiral gears in the specification of the State patent in suit. Will you say whether or not they are described as meshing with the spiral gears 75 and 83, respectively, and if such be the case make such comment thereon as may occur to you?

A. They are so stated as meshing with spiral gears 75 and 83. Of course, if the gears 76 and 82 were a different type of gears it would be impossible for them to mesh and operate properly with the gears 75 and 83. As I have already pointed out and confirmed by referring to

numerous authorities, what is often called a worm is nothing more or less than a spiral gear. What is called a worm looks somewhat different to the casual observer than a gear that is commonly called a spiral gear. He observes the teeth encircling the gear completely in the case of the worm, whereas in the case of the spiral gear there is just a little short section of teeth more nearly across the face. It looks different. He furthermore observes that the sides of the teeth of what he calls the worm are probably formed by a straight line; and he observes the teeth of what he calls the spiral gear curved, and naturally they look different, but there is no difference between them. They are both involute teeth, only it so happens that an involute tooth making a small angle with the plane perpendicular to the axis becomes a straight sided tooth, just like the teeth of a rack; whereas the teeth of a gear in which the teeth run more nearly across the face, become curved in order that they may be involute teeth. A worm is simply a spiral gear with one or two or three teeth, and it may have many teeth and still be called a worm by many writers, but usually it has one, two, three, or four teeth; whereas, what is called a spiral gear commonly, by many, has a larger number of teeth. In all gears, when the number of teeth change, the shape of the tooth must change, in order that they shall mesh properly, and so, for every spiral gear of a different number of teeth, there is a different shaped tooth used, and finally when it comes down to these gears with a fewer number of teeth, the sides of the teeth become straight, and if they were of any other form they certainly would not mesh with their spiral gears.

Rd-Q. 293. You have referred on cross-examination to the fact that the tires comprised in Plaintiff's Exhibits No. 18 and No. 19, when subjected to the bursting

test broke in or near the tread zone. What have you to say as to this particular effect and the reason for it?

A. It is due to the geometrical shape of the surface or the body of the carcass. The radius of curvature of the threads of the fabric is greatest in this section, due to the geometry of the thing, and as a result, for a given inner pressure, the stress becomes greatest in the threads at this portion and consequently, of course, they give way, when the tires burst, at this portion.

Rd-Q. 294. You speak on cross-examination of an "endless screw". Will you kindly explain what you mean by that term?

A. I mean a helix or a number of such helices about a cylinder which are meshing with a circular gear, so that it appears, on rotating the screw, as if it were endless, because as soon as one thread becomes disengaged with the teeth another thread come along and takes it up, and the action is the same as if a single thread were endless.

Rd-Q. 295. In other words, you mean that there is always an impelling surface in actual engagement with the impelled part?

A. That is correct.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. SEWARD:

Rx-Q. 296. Does the endless thread to which you have just referred, pass once or more than once around the circumference of the worm?

A. I think that is immaterial whether it goes around part of the circumference or many times, the effect is identically the same. I have never considered that there was any difference on this point.

Rx-Q. 297. Is the principle the same in operation?

A. Yes, the principle is just the same to all practical purposes.

Rx-Q. 298. It makes the same appearance whether the tooth goes around the circumference of the worm or whether it passes across the face of the worm?

A. In the case where the teeth of both gears are comparatively short, the appearance might be slightly different, but if you observe it carefully you can see the same effect.

Rx-Q. 299. Then you do not think that the word "endless" tooth defines the tooth which goes once or more around the circumference of the worm?

A. I have never considered the word "endless" tooth restricted to that condition where it goes around once or more.

Rx-Q. 300. At what angle of tooth in a worm does the straight side of the tooth change to a curved side?

A. Theoretically, in a worm there should not be any straight-sided teeth, because as soon as you get a worm or, in other words, a helix, then the thread makes an angle with the plane perpendicular to the axis; and, consequently, if you pass another plane perpendicular to the tooth through the gear, you will have an ellipse, so that the tooth section lying in this last mentioned plane really lies upon a curved surface, and theoretically then it should be slightly curved, but the curvature is so slight that for practical purposes they make it straight, and it is easier to machine in a lathe when it is straight, which is the usual way of machining a spiral gear when the angle is small like that. It would be very difficult in a lathe to machine a formed tooth, because you would have to have a formed tool, whereas, when the angles become greater it is usual to cut them in a milling machine, and then you can obtain Brown & Sharpe or other gear cutters which are properly formed and that is what is used.

Rx-Q. 301. And the result of the operation of these milling cutters is to make teeth with curved sides?

A. Yes, in general, although in the set of cutters to

make the complete range of teeth, there is included one cutter to make rack teeth with straight sides, but the ordinary lathe in which the usual gear of this type would be cut is not provided with means for driving such a cutter, so that it cannot be made use of except in a machine especially adapted to use it; so that such gears are commonly cut with a formed tool but with straight sides, as that is a simple form to produce.

Rx-Q. 302. Up to what tooth angle is it customary to cut the teeth with straight sides?

A. That practice differs. It would depend entirely upon the equipment of a machine shop as to how that would be done. You could cut a worm with a large angle with a straight side tooth and it would operate apparently all right and might do for most conditions. It is incorrect, however, in that it does not maintain a uniform velocity ratio between the driving gear and the driven gear. That is, as each tooth passes by the other tooth there is a slight acceleration and retardation of the driven gear, assuming the driving gear makes constant rotation. To prevent that is the object of making these special forms of gear teeth, the involute, for instance; it is not simply to get the teeth to mesh together. Most any form could be used for that, but there are only certain geometrical forms for the surfaces of the teeth which will give a uniform velocity ratio between the driving gear and the driven gear.

Rx-Q. 303. Up to what angle is it correct to form the teeth with straight sides?

A. No appreciable error probably, for ordinary work, would be produced by using straight sides up to 20°, or possibly for many purposes up to maybe a slightly higher angle, 25°.

Rx-Q. 304. Do you mean a 20° or 25° angle of pitch of the tooth with respect to the plane perpendicular to the axis of the worm?

A. Yes.

Rx-Q. 305. Is it a fact that when fluid pressure is admitted to the interior of a tire, its tendency is to force the tire into a shape circular in cross-section?

A. Yes, if we consider the walls of the tire as being perfectly flexible, then under internal pressure they take a circular cross-section.

Rx-Q. 306. And the force would be substantially equal in all directions?

A. Yes, the outward radial pressure would be equal in all directions. That is each square inch of surface of the inside of the tire would be subjected to the same load.

By Mr. Seward: I notify counsel for plaintiff that I shall want my expert to examine the model machine, "Plaintiff's Exhibit No. 29", after my expert returns from his vacation; and I therefore request counsel for plaintiff not to dismantle this exhibit or remove it to an inaccessible place.

Recross-examination closed.

Deposition closed. Signature waived.

Adjournment until Wednesday morning, August 11, 1920.

NEW YORK, N. Y., August 9, 1920.

Appearances: Same as before.

Whereupon ARTHUR F. BEDELL, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 1. What is your name?

A. Arthur F. Bedell.

Q. 2. Where are you employed, Mr. Bedell?

A. Goodyear Tire & Rubber Company, Akron, Ohio.

Q. 3. What is your position with the Goodyear Company?

A. Inspector in the Experimental Workshop.

Q. 4. Do you recall some tires that were made by Arthur R. Mackey, some sixty or ninety days ago, in the Goodyear plant at Akron, by the hand spinning method?

By Mr. Seward: I object to any testimony from this witness as to tests mentioned in Mr. Ray's deposition, on the ground that the same is immaterial, incompetent and irrelevant; and it is agreed that this objection may stand without repetition.

A. Yes, sir.

Q. 5. Who provided and delivered the material for those tires?

A. I provided and delivered it to Mr. Mackey.

Q. 6. And do you recall in the same connection some tires that were made on a Goodyear commercial machine by Al Shaw?

A. Yes, sir.

Q. 7. And who provided and delivered the material for those tires?

A. I provided and delivered it to Mr. Shaw.

Q. 8. Did you see these two sets of tires made, respectively, by Mr. Mackey and Mr. Shaw?

A. Yes, sir.

Q. 9. You say you saw these two sets of tires actually in construction by Messrs. Mackey and Shaw, respectively, is that correct?

A. Yes, sir.

Q. 10. Did you see the beads applied?

A. Yes, sir.

Q. 11. Did you see the chafing strips applied?

A. Yes, sir.

Q. 12. Did you see the rubber covers applied?

A. Yes, sir.

Q. 13. And was the material that you delivered, respectively, to Messrs. Mackey and Shaw, the same in both instances?

A. Yes, sir.

Q. 14. And is the same true in connection with the chafing strips and rubber cover?

A. Yes, sir.

Q. 15. And did you see these tires finished in each instance?

A. I did.

Q. 16. Do you know what was done with the tires after the carcasses had been formed and the finishing operation had been concluded?

A. Yes, sir.

Q. 17. What was it?

A. They were taken to the curing room and cured.

Q. 18. Who took them to the curing room?

A. Why, Mr. Shaw and I, the Mackey tires; and the machine made tires, Mr. Shaw and I and Mr. Ray.

Q. 19. Do you know whether or not the two sets of tires referred to were actually cured?

A. Yes, sir. They were.

Q. 20. Now, will you state whether or not the two sets of tires before you, Plaintiff's Exhibits Nos. 18 and 19, are the two sets of tires you have been testifying about?

A. Yes, sir.

Q. 21. How do you know that?

A. By marks. By the letter M on the Mackey tires, and the letter S on the Shaw,—the machine built tires.

Direct-examination closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 22. How long have you been with the Goodyear Company?

A. It will be five years the 19th of last April.

x-Q. 23. What positions have you held prior to the present one at the Goodyear plant?

A. The first position was on the tire testing machine; and the next, on cutting stock; then inspector, my present position.

x-Q. 24. How long have you held your present position?

A. About 2 years.

x-Q. 25. Did you see Mr. Mackey make every one of the tires comprised in Plaintiff's Exhibit 18?

A. Yes, sir.

x-Q. 26. Did you see him make each one throughout?

A. Yes, sir.

x-Q. 27. That is, you watched him make each of the tires in the said set completely from the start to finish?

A. Well, no, not every instant; I was not there every move he made on the tires but practically all.

x-Q. 28. Did you see him make the first tire in the said set entirely?

A. Yes, sir.

x-Q. 29. Every single thing?

A. Yes, sir.

x-Q. 30. How about the second tire?

A. I did not see everything. I saw it about half made before I went away.

x-Q. 31. And how much did you see made of each of the remaining tires of the said set?

A. Well, half of the tire anyhow.

x-Q. 32. You saw about the same amount of the making operation on each of the remaining tires of the set, is that right?

A. Yes, sir.

x-Q. 33. Were you standing near to Mr. Mackey?

A. Yes, sir.

x-Q. 34. Did you speak to Mr. Mackey about these tires?

A. No, I did not.

x-Q. 35. Did you hold any conversation with Mr. Mackey while he was making these tires?

A. Yes, I talked to Mr. Mackey some.

x-Q. 36. Did you say anything to Mr. Mackey about any of these tires?

A. Not to my knowledge, no.

x-Q. 37. Are you quite sure you did not mention these tires to Mr. Mackey, or any of them?

A. No, I did not.

x-Q. 38. You mean by that you did not speak to him about these tires?

A. That is right.

x-Q. 39. Was anyone else with you and Mr. Shaw when you took the tires Mackey made to the vulcanizer?

A. No, sir. I would like to add a word,—there was a helper whose name I cannot recall.

x-Q. 40. Anyone else?

A. No, sir.

x-Q. 41. Have you examined these tires comprised in Plaintiff's Exhibits 18 and 19, before you gave your testimony just now?

A. I saw them at the shop.

x-Q. 42. Have you examined them here to identify them?

A. Nothing more than looking at them.

x-Q. 43. Is the letter to which you referred evident on each of the tires of these sets at the present time?

A. Yes.

x-Q. 44. Is it on the tire or on the wrapper?

A. On the tire.

x-Q. 45. And you have looked at that letter on each of these tires?

A. Yes.

x-Q. 46. I mean this morning.

A. No, I have seen the letter S but not the letter M, this morning.

x-Q. 47. The fact is that these tires as they now stand, or the majority of them, are wrapped so that the letters to which you have referred are not apparent, is that so?

A. I have not been able to see the letter M,—the ones with the M on.

x-Q. 48. The statement in my last question then was true as to the majority of the tires bearing the letter M in Exhibit 18, is that right?

A. Yes, sir.

x-Q. 49. But you have actually examined this morning all the tires in Exhibit 19, so as to see the letter S on each one?

A. Why no, I have not. It would be impossible to see them without taking the wrappers off.

x-Q. 50. Then is it a fact that a majority of the tires in Exhibit 19 are wrapped so that the letter S is not apparent?

A. They are.

x-Q. 51. Did Mr. Mackey put the rubber cover on the tires which he made?

A. Yes, sir.

x-Q. 52. Did you see him put them on in every case?

A. Yes, sir, most of them.

x-Q. 53. Did he have anyone help him put them on?

A. No, sir, not that I saw.

x-Q. 54. Did Mr. Mackey put all the beads on all these tires he made?

A. Yes, sir.

x-Q. 55. He did that himself?

A. Yes, sir.

x-Q. 56. In every case?

A. As far as I saw; yes, sir.

x-Q. 57. On how many tires of this set did you see Mr. Mackey place the beads himself?

A. Well, better than half of them.

x-Q. 58. Did you supply the beads to Mr. Mackey?

A. Yes, sir.

x-Q. 59. Did you supply him all the material he used in making the tires?

A. Yes, sir.

x-Q. 60. Did you bring that to him in one lot for the ten tires, or in separate lots for each tire?

A. Yes, sir, for the ten tires in one lot.

x-Q. 61. Did you bring it to him all at one time?

A. Yes, sir.

x-Q. 62. And that was before he made the first tire of the set?

A. Yes, sir.

x-Q. 63. The tires in these sets, Exhibits No. 18 and No. 19, have no treads thereon, have they?

A. No, sir.

x-Q. 64. They have no breaker strips, have they?

A. No, sir.

x-Q. 65. By the tread in my previous question, I meant the outside rubber which contacts with the road while the tire is in use. You so understood it?

A. Yes, sir. That is the tread, yes, sir.

x-Q. 66. And by the breaker strip,—I refer to the loosely woven strip of fabric that is generally placed between the tread rubber and the layer of rubber that immediately covers the fabric. Do you so understand it?

A. Yes, sir, I understand it.

x-Q. 67. And that layer of rubber which immediately covers the fabric, you have referred to as the cover or it may be called the cushion?

A. Yes, it may be called either.

x-Q. 68. Did you see each of the tires made by Mr. Mackey vulcanized?

A. No, sir.

x-Q. 69. Did you see Mr. Shaw make every one of the tires included in Exhibit 19?

A. Yes, sir.

x-Q. 70. Did you see him make each tire completely?

A. Yes, sir.

x-Q. 71. From beginning to end?

A. Yes, sir.

x-Q. 72. When did Mr. Shaw make these tires?

A. Well, now, the latter part of May.

x-Q. 73. How did it compare in time with the time when Mr. Mackay was making his tires?

A. How do you mean?

x-Q. 74. Was it before, or after, or at the same time?

A. It was after Mackey, yes sir.

x-Q. 75. Then Mr. Shaw did not begin to make his tires until Mr. Mackey had finished his; is that right?

A. Yes, sir.

x-Q. 76. Did you provide all the material that Mr. Shaw used?

A. Yes sir.

x-Q. 77. Did you provide that in one lot, at one time?

A. Yes, sir.

x-Q. 78. The tires made by Mr. Shaw also omit the tread and breaker strip, do they not?

A. Yes, sir.

x-Q. 79. Who else was present when Mr. Shaw made these tires?

A. I forget the gentleman's name,—Mr. Ray, Mr. Shaw, and myself.

x-Q. 80. Anyone else?

A. No.

x-Q. 81. Are you sure of that?

A. Nothing more than the help in the shop there.

x-Q. 82. What do you mean by "the help"?

A. That is, the men that worked in the department.

x-Q. 83. Were they, or any of them, there observing Mr. Shaw, or were they doing their own work?

A. They were doing their own work,—merely passing by.

x-Q. 84. Then you mean to say that the only people who were observing Mr. Shaw's work were Mr. Shaw, Mr. Ray, and yourself?

A. Yes, sir.

x-Q. 85. Was that true of all the tires made by Mr. Shaw?

A. Yes, sir.

x-Q. 86. How long was it after Mackey finished his tires before Shaw started his?

A. Well I can't just recall the date as to that, the time.

x-Q. 87. Can you say about how long an interval there was?

A. Well, no. No, I could not.

x-Q. 88. Was it a week or less?

A. Well, I would say close on to that time.

x-Q. 89. Did you give any instructions to Mr. Shaw about making these tires?

A. No, sir.

x-Q. 90. Did you talk with Mr. Shaw about making them?

A. Yes, sir, we talked about the tires.

x-Q. 91. You talked to him about the tires while he was making them?

A. Yes, sir, as to the gages, etc., on the tires, what they should be.

x-Q. 92. Please tell me what you mean by "the gages"?

A. Why the gages of plies, that is the standard gages that they use in the standard tires of this size.

x-Q. 93. Do you mean that you talked with Mr. Shaw about the thickness of fabric to be used,—is that what you mean by "gages"?

A. Yes, sir.

x-Q. 94. Did he tell you what he wanted, or did you provide him what you thought was right in fabric?

A. I provided what he should have for that size.

x-Q. 95. What was the size of these tires?

A. 34-4.

x-Q. 96. All of them?

A. Yes, sir.

x-Q. 97. They are all straight sides?

A. Yes, sir.

Cross-examination Closed.

Deposition Closed.

Signature waived.

NEW YORK, N. Y., August 9, 1920.

Appearances: Same as before.

Whereupon WAYNE A. ROWLES, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 1. Please state your name.

A. Wayne A. Rowles.

Q. 2. Where are you employed, Mr. Rowles?

A. Goodyear Tire & Rubber Company, Akron, Ohio.

Q. 3. What is your position there?

A. Head inspector on curing.

Q. 4. How long have you occupied that position?

A. I have occupied that position three years.

Q. 5. Do you recall some sixty or ninety days ago superintending the curing of some special tires that were brought to you by Mr. Bedell and Mr. Shaw?

A. I do.

Q. 6. And also a set that was brought to you by Mr. Bedell, Mr. Shaw and Mr. Ray?

A. Yes, sir.

Q. 7. Did you superintend the curing of these tires?

A. I did.

Q. 8. Do you happen to remember how the tires that were given you at this time were marked for identification?

A. Yes, sir. With the letters S and M in the respective sets.

Q. 9. Can you tell me, generally, how these two sets of tires marked respectively M and S were cured?

A. Just a single cure.

Q. 10. I hand you two charts, marked Plaintiff's Exhibit No. 17, and ask you, if you can, to tell me what they are.

By Mr. Seward: I object to any testimony from this witness, or to the reception of any exhibits relative to the tests referred to by Mr. Ray on the ground that the same are immaterial, irrelevant and incompetent; and it is agreed that this objection may stand against the entire deposition of this witness without repetition, including the questions already asked.

A. Charts that show the cured tire.

Q. 11. How do they show it?

A. By the red line.

Q. 12. What do those red lines indicate?

A. Indicate the time the heat was on and off, and degrees of steam in vulcanizing.

Q. 13. Referring more particularly to the two sets of markings on those two charts, which are designated respectively M and S in blue pencil, will you tell me, if you can, what those particular markings signify and relate to?

A. They indicate that special cure.

Q. 14. What do you mean by "special cure"?

A. It is another cure other than the two other heats shown on this chart.

Q. 15. Do you mean that when you used the word "special" that the cure was an extraordinary one or differed from the usual practice, or merely that the word designates a cure different from the other cures indicated on the same charts?

A. It designates another cure from the ones on the charts.

Q. 16. For instance, how long a cure is indicated by the markings designated M and S, respectively?

A. Two hours and fifty-five minutes.

Q. 17. And how long were the other cures indicated on the same charts?

A. Two hours.

Q. 18. Were these other cures indicated on the same charts single cures or double cures?

A. Double cures.

Q. 19. What do you mean by "double cures"?

A. In the double cure we first cure the carcass by itself, which constitutes the first step; we then cure it a second time after the tread has been applied, which is the second step.

Q. 20. I understand from your last answer that this double cure process was not followed in connection with the two cures which are designated by the blue letters M and S, but in these two instances the cures were single cures. Is that correct?

A. Yes.

Q. 21. What is the ordinary time that is given in the single cure method of vulcanizing?

A. I cannot answer that question. If you refer to the two specially designated cures you mentioned, it was two hours and fifty-five minutes.

Q. 22. Was two hours and fifty-five minutes the proper period to employ in giving this single cure.

A. It was, to the tires mentioned.

Direct-examination Closed.

CROSS-EXAMINATION BY MR. SEWARD:

x-Q. 23. Do you have charge of the curing of all tires at the Goodyear plant?

A. No, sir.

x-Q. 24. Do you simply have charge of the inspection of the curing?

A. Of straight side tires.

x-Q. 25. Are the tires of which you have charge of the inspecting, cured by two cures or by one?

A. Which tires do you refer to?

x-Q. 26. I am not referring to these exhibits.

A. You are not?

x-Q. 27. No.

A. Well then, they have two cures.

x-Q. 28. You then, in the regular course of your work, do not inspect the tires made by the single cure process? I mean the process in which the complete tire is given only one cure.

A. No, I do not inspect that.

x-Q. 29. The tires which you inspect are those in which the carcass and rubber cover are first partially cured, and then the same tire with the addition of the tread is completely cured in a second cure, is that right?

A. Yes, sir.

x-Q. 30. On these charts which you have referred to, the cures other than those marked M and S are the cures of the carcass and rubber cover of other tires, is that right?

A. Yes, sir.

x-Q. 31. And those cures were made in the regular course of business?

A. Yes, sir.

x-Q. 32. And the time of the cure was two hours in each case?

A. Yes sir, in each case.

x-Q. 33. That period of two hours was for the first of the two cures in each case?

A. Yes, sir.

x-Q. 34. Then those tires indicated on the charts, other than the tires marked S and M, were later given a second cure. Is that right?

A. Yes, sir.

x-Q. 35. How long was the second cure in each case?

A. That I cannot answer.

x-Q. 36. Why can't you answer it?

A. I never worked around there and had nothing to do with the cure.

x-Q. 37. Then, if I understand you correctly, you inspect only the first cure in the two-cure process. Is that right?

A. Only, yes, sir.

x-Q. 38. These tires marked S and M were in the same condition as the other tires indicated on the chart,—I mean in the same condition as to their stage of completion, were they not?

A. Yes, sir.

x-Q. 39. But these tires marked S and M were cured for fifty-five minutes longer than the other tires indicated on the charts?

A. Yes, sir.

x-Q. 40. Were these tires marked S and M the same size as the other tires indicated on the charts?

A. Yes, sir.

x-Q. 41. Is it your custom to fill each vulcanizer with tires only of the same size, in curing?

A. No, sir.

x-Q. 42. Do you vary the temperature of the cure, or the time of the cure for different sizes of tires?

A. Vary the time.

x-Q. 43. The temperature remains constant?

A. Yes, sir.

x-Q. 44. Before you cured these tires marked S and M, had you ever completely cured a tire carcass with the rubber cover thereon but without the tread?

A. I, personally, had not.

x-Q. 45. Had you superintended such a cure?

A. No, sir.

x-Q. 46. Why do you say that two hours and fifty-five minutes was the proper cure for these tires marked S and M?

A. I only cure according to instructions.

x-Q. 47. Then you, yourself, did not set that time of two hours and fifty-five minutes?

A. No, sir.

x-Q. 48. Who gave you those instructions?

A. Mr. Shaw,—Al Shaw.

x-Q. 49. Did you write anything on either of these charts?

A. I did.

x-Q. 50. Did you write the expression "2 hrs. cure at 284" on each of the charts?

A. I did not.

x-Q. 51. What did you write on these charts?

A. Special cure.

x-Q. 52. Together with your name?

A. Name, yes sir, on one.

x-Q. 53. You did not write "special cure" on more than one, did you?

A. Yes, sir, I wrote "special cure" on both of them.

x-Q. 54. On one of these charts the initials "J. F." in lead pencil appear under the words "special cure". Did you write those initials there?

A. No, sir, that is the steam tender,—the time he started to work.

x-Q. 55. What does "150 B" mean on each of these charts?

A. It denotes the department number.

x-Q. 56. And what does "H. 32" and "H. 33" mean?

A. Number of heater or vulcanizer.

x-Q. 57. What does 83/80 and 83/79 mean?

A. That is the serial number of the vulcanizer.

x-Q. 58. These charts are dated May 27, 1920 and May 28, 1920. Does that mean that the tires marked M and S were cured on these two days?

A. Yes, sir.

x-Q. 59. The red ink line on the chart bearing the letter M in blue, shows a depression or inward curve near one edge. Can you explain what that means?

A. Vibration of the heater.

x-Q. 60. What do you mean by vibration of the heater?

A. Its working jars or causes the pen to mark a vibration on the chart.

x-Q. 61. On the chart, would this not indicate that the temperature had fallen towards 280 for a period?

A. It denotes on there it had fallen for a period.

x-Q. 62. One of these charts has the name "Fearner" on it. Who wrote that on?

A. Fearner, himself. He was the steam tender.

x-Q. 63. What does the steam tender do?

A. He turns the steam on and off.

x-Q. 64. Does his name apply to each cure or heat on the chart, or to only one cure?

A. It only applies to the shift of his working. It don't apply to any single cure.

x-Q. 65. That is, his name does not apply to the cure of the tires marked S and M, is that right?

A. No, sir, it does not apply to them.

x-Q. 66. On the back of one of these charts it says: "Hold for A. Shaw". Did you write that there?

A. I did.

x-Q. 67. Why did you write that?

A. So the chart would not go through to the Superintendent's office with the rest. We wanted to hold it up.

x-Q. 68. You wanted this chart held out specially, instead of going through in the regular course with the other charts?

A. Yes, sir.

x-Q. 69. One of these charts indicates that Mr. Fearner was the steam tender in charge of the cure of the tires marked M, does it not?

A. Why no, sir. It is just where he starts to work. He puts his initial on the chart to show that that is the shift he worked, and that cure came right over his name.

x-Q. 70. Does it mean he was working when the tires marked M were being cured?

A. Yes, sir.

x-Q. 71. And was he the man who had charge of turning the steam on for the cure of the tires marked M?

A. He turned it on.—I had charge of it.

x-Q. 72. On the chart bearing the letter S in blue, there appears to be some lead pencil writing underneath the words written in ink "special cure Rowles". Can you tell me what that lead pencil is?

A. That is "special cure Rowles". I retraced it in the office, with ink.

x-Q. 73. What position did you hold before your present one?

A. Tending steam.

x-Q. 74. At the Goodyear plant?

A. Yes, sir.

x-Q. 75. For how many years?

A. Five years.

x-Q. 76. And what before that?

A. That is as long as I worked at the Goodyear.

Cross-examination closed.

Deposition closed. Signature waived.

NEW YORK, N. Y., August 11, 1920.

Met pursuant to adjournment.

Appearances: Same as before.

Whereupon WILLIAM H. PRICE, JR., a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 1. What is your name?

A. William H. Price, Jr.

Q. 2. Where are you employed, Mr. Price?

A. Goodyear Tire & Rubber Company, Akron, Ohio.

Q. 3. And what is your position there?

A. Assistant Manager of the Technical Service Division.

Q. 4. How long have you occupied that position?

A. One year and a half.

Q. 5. How long have you been altogether in the employ of the Goodyear Company?

A. Four and one-half years.

Q. 6. And prior to your present position, what duties did you perform?

A. I was actively engaged in the development and service compounding of all pneumatic tire stocks.

Q. 7. During the course of your employment with the Goodyear Company, have you become familiar with the curing or vulcanizing of tires?

A. I have.

Q. 8. And you are familiar with the Goodyear practice in determining whether or not tires are properly cured?

A. I am.

Q. 9. I call your attention to the tire comprised in Plaintiff's Exhibit No. 18, and marked M[6], and ask you to state whether or not that tire has been properly cured

according to the Goodyear commercial practice and tests, and give the reason for your answer.

A. I have examined the tire M^6 and it is, according to the Goodyear standard practice, properly cured. For that purpose I have cut out a section of the tire which I have specifically examined and which is in part the basis for my statement.

Q. 10. I direct your attention to Plaintiff's Exhibit No. 17 comprising two charts, and particularly therein to the red lines marked in blue pencil "M" and "S", and ask you to state whether or not these charts indicate that the heat treatment thereby recorded was the proper curing or vulcanizing treatment for a single cure in connection with 34-4 tires.

A. The curing chart on the "M" tire representing a single cure, is the correct cure for that particular tire. The cure for the first cure on the "S" tire is also correct.

Q. 11. Do I understand you to say that the red lines marked "S", that you have referred to, indicate the first step of a double cure?

A. No, sir. I am in error there. That represents a single cure, I find on adding up the number of minutes employed.

Q. 12. In other words, both of the cures indicated by the blue letters "M" and "S" are single cures, is that correct.

A. Yes, sir.

Q. 13. I will ask you to examine again the cure indicated by the blue letter M, and to note particularly the slight jog or depression in the red line, near the end of the cure, and to state whether or not the variation in temperature or pressure indicated thereby would at all affect the efficiency of the particular cure.

A. No, the jog in the curing curve at the end, would not affect to any extent the efficiency of the particular cure.

Q. 14. Are you familiar with the rubber compounds used commercially by the Goodyear Company?

A. Yes, sir.

Q. 15. Can you state from that familiarity the number of the compound that was used for standard practice during the month of May, 1920?

A. Yes, sir. 1787 compound, used for friction and coat.

Direct-examination closed.

Cross-examination by Mr. Seward:

x-Q. 16. In order to test Exhibit tire M[6], you cut out a section about an inch in dimension, considered circumferentially of the tire, and extending across the tread portion of the tire from about an inch and one-quarter to about an inch and three-quarters above the bead on each side, is that correct?

A. I did.

x-Q. 17. Is that the only test you made on that tire?

A. Yes, sir.

x-Q. 18. How did you test that section?

A. The section was tested by first separating two of the frictioned and coated plies of the carcass and subsequently examining them for cure with the 1787 compound; a further test was made by cutting off a portion of the side wall stock and testing that for stretch and set; the final test made upon this section was to strip back a portion of the 1787 top cover and test this for stretch and set.

x-Q. 19. With what did you compare the result of these tests in order to determine whether or not the cure was correct?

A. I compared the results of this test section with Goodyear standard practice and results in order to determine whether or not this was a proper cure.

x-Q. 20. What do you mean by "Goodyear standard practice and results"?

A. I mean that it is Goodyear standard practice to examine sections of tires for correctness of cure, in this manner, and to rely upon the results obtained as a direct indication of the cure.

x-Q. 21. Are these sections examined in accordance with Goodyear standard practice with which you compared the results of this test, sections of carcasses or of completed tires?

A. The sections examined in the Goodyear standard practice with which the special section was compared, are treaded tires.

x-Q. 22. You mean, do you not, complete tires which have been vulcanized to a finished condition by one cure?

A. No, sir.

x-Q. 23. Do you mean complete tires which have been vulcanized to a finished condition by two cures?

A. I do.

x-Q. 24. In that two-cure vulcanization, the carcass, including the cushion or cover, is first partially cured; after which the breaker strip and tread are applied and the entire tire completely vulcanized in a second cure?

A. That is correct.

x-Q. 25. With reference to the chart, Plaintiff's Exhibit No. 17, on which the letter M in blue appears, the jog in the curing curve covers a time period of about fifteen minutes and a change in temperature of about four degrees, does it not?

A. It does.

x-Q. 26. The total period of that cure was a little less than three hours, is that correct?

A. It is.

x-Q. 27. When you say that the 1787 compound was Goodyear standard practice in May for friction and coat-

ing, do you mean for the rubber with which the fabric used in making the carcass was impregnated and coated?

A. I do.

x-Q. 28. The fabric is thus impregnated and coated before the tire is built up, is that correct?

A. Yes, sir.

x-Q. 29. Was this 1787 standard for the two-cure tires or the one-cure tires, or both?

A. For the two-cure tire.

Cross-examination closed.

REDIRECT-EXAMINATION BY MR. ROGERS:

Rd-Q. 30. I understand that there are two methods of vulcanizing employed in the Goodyear factory, namely, the single cure method and the double cure method. Is the result aimed at to procure the same ultimate result in the vulcanizing of the tire, whether the one-cure method or the two-cure method be employed?

A. It is.

Rd-Q. 31. Do I understand from your last answer that the condition of the vulcanized carcass would be the same whether the cure is made in one step or in two steps?

A. The condition of the vulcanized carcass with respect to quality would be the same whether a single or double cure were used. I would like to add to that, if I might, provided the proper cure were obtained.

Rd-Q. 32. In making the tests you have referred to, would those tests be the same whether the single cure or the double cure method were employed?

A. They would.

R-d-Q. 33. Would it make any difference whether or not the tread was actually on the tire, in determining the condition of the cure?

A. No, sir.

Rd-Q. 34. Do you regard the time indicated on these vulcanizing charts (slightly less than three hours) as a

proper time of cure for tires in the single cure method in connection with the compound 1787?

A. I do.

Rd-Q. 35. Do I understand correctly that the character of test you have employed in connection with the particular tire under discussion, would be exactly the same as you would employ if that tire had been cured by the two step method?

A. Yes, sir.

Redirect-examination closed.

RECROSS-EXAMINATION BY MR. SEWARD:

Rx-Q. 36. Do you mean that this exhibit tire M^6 was cured for a period of time and at a temperature the same as would be given a complete 34-4 tire cured by the single cure in accordance with the Goodyear standard practice?

A. I am not at liberty to give testimony to the effect that Goodyear would cure a 34-4 straight side fabric tire in the same cure as exhibit tire M^6; but I do testify that the cure given to exhibit tire M^6 is a proper cure to attain the desired quality.

Rx-Q. 37. One of the re-direct questions and answers was, as follows: "Do you regard the time indicated on these vulcanizing charts (slightly less than three hours) as a proper time of cure for tires in the single cure method in connection with the compound 1787? A. I do."

Upon what do you base your answer to the said question?

A. I base my answer to the said question on an intimate knowledge of so-called curing curves of the aforementioned 1787 stock.

Rx-Q. 38. And you do not base it upon comparison with Goodyear practice in curing single cure tires?

A. Not wholly.

Rx-Q. 39. When you referred to the two-cure process

or vulcanization, did you refer to that process in which an uncured tread is applied to a partially cured carcass, or a partially cured tread applied to a partially cured carcass, before the second cure?

A. That which we have discussed may refer to either a green tread, so-called, or a partially cured tread. It is equally applicable to both.

Rx-Q. 40. The cure given this exhibit tire carcass M^6 was nearly fifty per cent. longer than that given to the carcass in the first cure of the two-cure process according to Goodyear standard practice, is that correct?

A. It was.

Rx-Q. 41. And the temperature of the cure was the same in both cases?

A. Substantially so.

Recross-examination closed.

Deposition closed. Signature waived.

NEW YORK, N. Y., August 11, 1920.

Appearances: Same as before.

Whereupon ROLAND S. TROGNER, a witness called on behalf of the plaintiff, being first duly sworn, in answer to interrogatories propounded to him by Mr. Rogers, deposes and says, as follows:

Q. 1. What is your name?

A. Roland S. Trogner.

Q. 2. Where are you employed, Mr. Trogner?

A. Goodyear Tire & Rubber Company, Akron, Ohio.

Q. 3. How long have you been with the Goodyear Company?

A. Four years and two months, approximately.

Q. 4. Have you made any investigation to determine

the similarity or dissimilarity between the Goodyear commercial carcass-making machines and the carcass-making machines supplied by plaintiff to his licensees?

A. I have.

Q. 5. What was the nature of that investigation. How did you make it?

A. I went through the old records, old photographs, tire machine orders, and other data relating to this particular subject.

Q. 6. During the time since you have been with the Goodyear Company, have you had personal knowledge of the machines that were sent out to licensees?

A. I have had personal knowledge during the entire time I have been with the Goodyear Company.

Q. 7. Will you please say whether or not the machines sent out to plaintiff's licensees have been the same as those used by the Goodyear Company in commercial practice? In this connection please understand that I am more particularly interested in the side forming devices, namely, the slide or carriage, the arms thereon which support the spinning-rolls, the spinning-rolls carried thereby, and the means for forcing the spinning-rolls against the side of the core. Unless defendant's counsel is interested in the subject, you need not discuss extraneous details such as the fabric supply devices, the tension mechanism, the bead placing devices, etc., etc.

A. I would say they were substantially the same.

Q. 8. Can you state to what extent, if at all, there have been variations in the form of the side forming devices under discussion? If you like, and to clarify your answer, you may refer to any photograph or the like you may have in your possession.

A. There have been changes made in the forms of springs used to force or retain the forming disk against the core, as well as the particular arrangement of manipulating the stitcher arms manually. There have

also been changes made in the method of mounting the forming disks upon the end of the arms.

I present two photographs which I have selected as typical of the form of machines referred to by me, No. 1 being a very early form of machine, No. 2 being a later form of machine.

Plaintiff's counsel introduces the two photographs in evidence, marked "Plaintiff's Exhibit No. 35, Photographs of State Machines".

Q. 9. You said that changes have been made from time to time in the devices employed for forcing the forming rolls against the side of the core. Will you say more concisely what you mean by that general statement?

A. In the early days, as clearly shown in photograph No. 1, they used upstanding pins to control the movements of the stitcher arms. These upstanding pins were later removed or cut off, and a cam plate mounted on the carriage for effecting the movement of these arms. The cam plate was formed with slots which were in engagement with the stitcher arms in such a way that the movement of the cam in one direction caused the two arms to be brought together, thereby causing the stitcher arms to free the core; and whereby the movement of the cam in the opposite direction caused the stitcher arms to engage the core.

Q. 10. What was the advantage of this cam plate arrangement?

A. It enabled the operator to control the action of the stitcher arms to a far better extent than the upstanding pins.

Q. 11. In other words, the manipulation of the cam plate moved both stitcher arms, is that correct?

A. It did.

Q. 12. Was it possible in the other form of device to

which you referred, for the operator to control both of the stitcher arms with one hand?

A. It was possible.

Q. 13. But the slotted cam plate made it more convenient for the operator, is that correct?

A. Yes, sir.

Q. 14. Now referring to the springs or other means employed for forcing the rolls against the side of the core, what, if any, change was made in these devices?

A. In the early days they used a spiral compression spring to force the stitcher disks against the core, which were subsequently removed and a torsion spring substituted, for the same purpose.

Q. 15. Are these two changes to which you referred, —the substitution of the cam plate for the two upstanding handles of the stitcher arms, and the torsion spring instead of the compression spring,—indicated in the two photographs which you have produced?

A. They are not. No. 1 shows, in the case of the controlling mechanism for the stitcher arms, the upstanding pins I referred to; whereas, in photograph No. 2, the cam plate is illustrated.

In the case of the springs, photograph No. 1 shows the spiral compression springs I referred to. In the case of the springs, both photographs show the spiral compression springs I referred to. The torsion springs substituted at a later date are not shown in either of the photographs.

Q. 16. I note in photograph No. 2 that the slide or carriage seems to be provided with a stop. What was the purpose of that arrangement?

A. That was used to limit the forward movement of the carriage.

Q. 17. Was that provision of the stop embodied in all subsequent machines?

A. It was not.

Q. 18. Why not?

A. They found in later practice that this was unnecessary.

Q. 19. Now, you have referred to three differences in construction and arrangement of the side forming devices, namely, the substitution of a torsion spring for a compression spring, the substitution of a control cam plate for the two upstanding handles of the arms, and the employment of a stop to limit the travel of the slide or carriage. Will you state whether or not there were any additional changes or modifications in respect to the side forming devices, in either the machines used by the Goodyear Company commercially or those furnished to its licensees by plaintiff?

A. They have from time to time changed the form of mounting the stitcher disks on the stitcher arms. These changes related to the form of ball bearing and raceways used. I would say that no other substantial changes have been made in the side forming devices of these machines.

Q. 20. Were these changes made from time to time in both the Goodyear commercial machines and also in the licensee machines?

A. They were.

Q. 21. Do you know of any instances where machines previously employed by the Goodyear Company commercially were sent out to licensees?

A. I do. I would say that a large portion of Mr. Seiberling's licensees were supplied with machines that were previously used commercially in the Goodyear factory.

Q. 22. You may state, generally, how such machines were provided to the licensees.

A. In the case of licensees who wanted supposed used machines, they were completely rebuilt and placed in first-class condition before being shipped to the licensee. I mean that the gears were replaced, bearings rebabbitted, new parts supplied for those that were worn, etc.

Q. 23. When these machines were rebuilt for the

purpose of supplying them to licensees, was their construction altered?

A. Not unless the licensee requested it.

Q. 24. From the result of your own experience and the investigation you have made on the subject, would you say that so far as the side forming devices are concerned, the machines used by the licensees have been substantially the same as those used by the Goodyear Company?

A. I would say that the side forming devices were substantially the same in both cases.

Q. 25. In my previous questions I have limited you to the discussion of the side forming devices. You don't mean to say, do you, that there were no changes in other parts of the machine, such as the fabric supply mechanism, tension devices, etc., etc.?

A. I do not mean to say that there were not other changes made outside of the side forming mechanisms.

By Mr. Seward: I object to the entire direct-examination as incompetent, immaterial and irrelevant, and move to strike the same out.

Direct-examination closed.

Cross-examination by Mr. Seward:

x-Q. 26. Does photograph No. 1 of Plaintiff's Exhibit No. 35 show at the right a partially constructed tire in which the outer layer of fabric has been stretched circumferentially on the core, and the side forming spinning-rolls are approximately at the beginning of their inward movement?

A. Yes, it does.

x-Q. 27. Does Photograph No. 2 of Plaintiff's Exhibit No. 35 show a partially formed tire in which the outer layer of fabric has been circumferentially stretched on the core, and the side forming spinning-rolls have

traversed part of their inward movement and thereby partially formed the said layer of fabric on the side of the core?

A. It does.

x-Q. 28. In this Photograph No. 2 the side forming rolls have not completed their inward movement or operation on the outer layer of fabric, have they?

A. I would say that the spinning rolls have just about completed their inward radial movement on the outer layer of fabric on the core.

x-Q. 29. I shall have to ask your age, Mr. Trogner.

A. 27,—28 in November.

Cross-examination closed.

Deposition closed. Signature waived.

Plaintiff's counsel, in response to the request by defendant's counsel, during the deposition of the witness Seiberling, for more definite information on certain points, states he is advised, as follows:

In connection with x-Q. 155, that since January 1919 plaintiff has not provided his licensees with any machines which embodied further improvements shown in patents subsequent to the State patent in suit.

In connection with x-Qs. 156 to 158, that the Howe Rubber Company of New Brunswick, New Jersey, did not accept the modified form of license referred to, and returned to plaintiff the single machine it had been using.

In connection with x-Qs. 159 and 160, that no other licensee has refused to accept the modified form of license or returned its machine; although negotiations have not been conducted to the final point with several of the licensees who are still working under the original agreement.

In connection with x-Q. 161, that among the names of the licensees, specified in answer to Q. 49, those who have taken a license since January, 1919, are the following:

The Batavia Rubber Company,
The George Grow Auto Company,
The Ideal Tire & Rubber Company,
The Iowa Cord Tire Company,
The Marion Tire & Rubber Company,
The New Castle Rubber Company,
The Owen Tire & Rubber Company,
The Quality Tire & Rubber Company,
(License transferred from Long Wear Rubber Co.)
The Rubber Products Company,
The Yale Tire & Rubber Company.

In connection with x-Qs. 198 to 200, plaintiff's counsel produces copies of the forms of license agreement that plaintiff has been using since January, 1919, and introduces the same in evidence as "Plaintiff's Exhibit No. 16, Plaintiff's Forms of License Agreement Since January 1919."

Proofs closed.

WM. R. STANSB
CLE

184432

IN THE

STATES SUPREME COURT,

OCTOBER TERM, 1923.

No. 185.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

BRIEF FOR PETITIONER.

LIVINGSTON GIFFORD,
E. CLARKSON SEWARD,
THOMAS G. HAIGHT,
Counsel for Petitioner.

ning Post Job Printing Office, Inc., 154 Fulton St., New York, N. Y.

INDEX.

	PAGE
Statement	1
So-Called Hand Making of Tires	2
State Patent in Suit	7
Specification of Errors	12
Defenses	13
Brief History of the Sixth Circuit Case	14
Brief History of the Third Circuit Case	16
Plaintiff's change of Front	18
Brief Recital of Prior Art	20
Moore Patent of 1894	21
Seiberling & Stevens Patent of 1904	24
Vincent Patent of 1905	27
Mathern Belgian Patent of 1906	29
Controlling Point of Difference Between Third and Sixth Circuits	35
Overestimate of State's Importance	43
The Disclaimer does Not Avoid the Sixth Circuit Decision	49
The Disclaimer Invalidates the Patent for the Four Following Reasons	53
The Disclaimer Usurps the Function of a Reissue	53
The Disclaimer Rewrites the Claims.	58
The Disclaimer has Changed the Patent from a Machine Patent to a Method Patent	79
The Disclaimer Unqualifiedly Cancels Claims that Include the Whole Substance of the Claims Sustained by the Court Below	86

PAGE

The Method or Mode of Operation Read into the State Patent by the Disclaimer was Old 87
Plaintiff's *Ex Parte* Tests of the Hand Spinning Method Support Defendant's Position 101
The Step Covered by the Claims..... 105
The Claims in Suit are Anticipated by Belgian Patent to Matherne..... 106
Seiberling and Stevens Patent..... 126
Vincent Patent 130
Chief Claims of State Patent were Granted Because Patent Office was Misled by Plaintiff 131
Moore Patent..... 135
The Sixth Court of Appeals did Not Rely Upon the Defense of Aggregation Alone. 137
State was not the Sole Inventor of His Patent and it is, Therefore, Void..... 138
Non-Infringement..... 145
Conclusion 157
Opinion of the Court of Appeals for the Sixth Circuit.....Appendix

INDEX OF CASES CITED.

PAGES

Adams v. *Bellaire*, 141 U. S. 539.....46, 131
Agawam v. *Jordan*, 74 U. S. 583..... 144
Albany v. *Worthington*, 79 F. R. 966..... 66, 71
American v. *Newgold*, 108 F. R. 957..... 138
American v. *Wood*, 189 F. R. 391..... 144
Appleton v. *Star*, 60 F. R. 411..... 121
Archer v. *Imperial*, 207 F. R. 81..... 131

Bannerman v. *Sanford*, 99 F. R. 294..... 138
Barber v. *Otis*, 271 F. R. 171..... 119
Barrett v. *Hall*, 1 Mason, 447; 2 Fed. Cas. 914, 924, No. 1,047..... 138
Bemis v. *Charles*, 177 F. R. 717..... 101
Bethlehem v. *Niles*, 166 F. R. 880..... 101
Boyd v. *Janesville*, 158 U. S. 260..... 145
Bracewell v. *Passaic*, 107 F. R. 467..... 50
Burr v. *Duryee*, 1 Wall. 531..... 152
Busch v. *Jones*, 184 U. S. 598..... 80

Campbell v. *Duplex*, 101 F. R. 282..... 131
Carter v. *Perry*, 1875 Dec. Com. Pat. 111... 144
Century v. *Wagner*, 192 F. R. 564..... 119
Chase v. *Chase*, 1873 Dec. Com. Pat. 99..... 143
Cheshire v. *Cox*, 229 F. R. 415..... 143
Cimiotti v. *American*, 198 U. S. 399.....65, 157
Cohn v. *U. S.*, 93 U. S. 366..... 119
Conroy v. *Penn*, 155 F. R. 421 (aff. 159 F. R. 943).....16, 104
Corbin v. *Eagle*, 150 U. S. 38..... 72
Corning v. *Burden*, 15 How. 252..... 145
Cross v. *MacKinnon*, 11 F. R. 601..... 152

Dashiell v. *Grosvenor*, 162 U. S. 425..... 119
De Mayo v. *Michener*, 231 F. R. 736..... 12
Duer v. *Corbin*, 149 U. S. 216..... 46
Dunbar v. *Myers*, 94 U. S. 187..... 49, 50

PAGES

Eames v. *Godfrey*, 68 U. S. (1 Wall.) 78... 157
Eby v. *King*, 158 U. S. 373..... 53
Enameled v. *Western*, 269 F. R. 620..... 71
Expanded v. *Bradford*, 214 U. S. 366..... 80

Fielding v. *Crouse*, 154 F. R. 377..... 12, 48
Fisher v. *Automobile*, 201 F. R. 543 (aff. 209 F. R. 255)..... 71
Fuller v. *Yentzer*, 94 U. S. 299..... 120

Gordon v. *Warder*, 150 U. S. 47..... 34
Gottfried v. *Phillip*, 5 Ban. & A. 4; 10 Fed. Cas. 841, 843, No. 5,633..... 144
Grant v. *Walter*, 148 U. S. 547..... 34, 85
Gray v. *Grinberg*, 159 F. R. 138..... 152

Hailes v. *Albany*, 123 U. S. 582..56, 62, 66, 70, 79
Hawser v. *Anton*, 233 F. R. 262..... 155
Heald v. *Rice*, 104 U. S. 737..... 80
Herman v. *Youngstown*, 191 F. R. 579..... 155
Hildreth v. *Mastoras*, 257 U. S. 27..... 14
Hillborn v. *Hale*, 69 F. R. 958..... 50
Huber v. *Nelson Mfg. Co.*, 148 U. S. 270... 65

In re Peters, 289 F. R. 637..... 80
Ironclad v. *Dairyman's*, 143 F. R. 512..... 119
Imhauser v. *Buck*, 101 U. S. 647..... 152

Jacobs v. *Almond*, 177 F. R. 935..... 131
Jewell v. *Jackson*, 140 F. R. 340..... 155
Johnson v. *Lambert*, 234 F. R. 886..... 12

Knapp v. *Morss*, 150 U. S. 221.....34, 120
Kokomo v. *Kitselman*, 189 U. S. 8..... 145

Leeds v. *Victor*, 213 U. S. 301..... 80
Leggett v. *Avery*, 101 U. S. 256..... 65

PAGES

Marchand v. *Empken*, 132 U. S. 195..... 104
Mark v. *Greenwald*, 32 App. D. C. 253..... 101
Mast v. *Stover*, 177 U. S. 485..... 131
McCarty v. *Railroad*, 160 U. S. 110..... 155
McClain v. *Ortmayer*, 141 U. S. 419..... 46, 72
McKinnon v. *American*, 268 F. R. 353.....138, 144
Miller v. *Brass*, 104 U. S. 350..... 57, 72
Miller v. *Eagle*, 151 U. S. 186.....34, 145
Minerals v. *Butte*, 250 U. S. 336..... 65
Moffitt v. *Garr*, 66 U. S. 273..... 53
Morgan v. *Albany*, 152 U. S. 425..... 63
Motion v. *Universal*, 243 U. S. 502..... 63

National v. *Interchangeable*, 106 F. R. 693.. 120
National v. *Wheeler*, 79 F. R. 432..... 156
New York v. *Chain*, 254 U. S. 32..... 120

Olin v. *Timken*, 155 U. S. 155..... 46
Overweight v. *Henry*, 102 F. R. 957..... 131

Parker v. *Yale*, 123 U. S. 103..... 57
Peters v. *Active*, 129 U. S. 530..... 34
Pickering v. *McCullough*, 104 U. S. 310...119, 120
Pittsburg v. *Pittsburg*, 109 F. R. 644..... 152
Price v. *Kelly*, 154 U. S. 669..... 152

Quincey v. *Krause*, 151 F. R. 1012..... 144

Rich v. *Baldwin*, 133 F. R. 920..... 131
Rodman v. *Deeds*, 261 F. R. 189..... 155
Rosemany v. *Halifax*, 288 F. R. 683..... 55, 61
Rubber Co. v. *Goodyear*, 76 U. S. 796..... 157

Sawyer v. *Edison*, 1883 Dec. Com. Pat. 80.. 144
Sciberling v. *Firestone*, 257 F. R. 80..14, 18, 23, 26, 38, 49, 68, 88, 106, 124, 126, 127, 129, 135, 137
Shepard v. *Carrigan*, 116 U. S. 592..... 65
Sieber v. *Chicago*, 184 F. R. 930..... 131
Silsby v. *Foote*, 14 How. 218..... 71

PAGES

Sirocco v. *Sturtevant*, 220 F. R. 137..... 122
Smart v. *Wright*, 227 F. R. 84.....138, 144
Societe v. *George*, 135 F. R. 102..... 50
Standard v. *Standard*, 223 F. R. 779..... 119
Steward v. *American*, 215 U. S. 161..... 152
Stimpson v. *Woodman*, 10 Wall. 117..... 131
Strause v. *William*, 235 F. R. 126..... 66, 71
Superior v. *August*, 273 F. R. 482..... 152

Thatcher v. *Burtis*, 121 U. S. 286..... 34
The Railroad Supply Co. v. *The Elyria Iron & Steel Co.*, 244 U. S. 285..... 101
Thomas v. *Weeks*, 1 Fish., 5; 23 Fed. Cas. 978, 981, No. 13,914..... 138
Thompson v. *Union*, 86 F. R. 636..... 155
Thropp v. *de Laski*, 226 F. R. 941..... 144
Tilghman v. *Proctor*, 102 U. S. 707..... 80
Topliff v. *Topliff*, 145 U. S. 156..... 119

Union v. *U. S.*, 112 U. S. 624..... 50
United v. *Sturtevant*, 122 F. R. 470 (aff. 125 F. R. 378)..... 131

Van Epps v. *United*, 143 F. R. 869..... 119
Voightmann v. *Weis*, 133 F. R. 298 (aff. 148 F. R. 848)..... 131
Vrooman v. *Penhollow*, 179 F. R. 296..... 143

Wessel v. *United*, 139 F. R. 11..... 120
Westinghouse v. *New York*, 139 F. R. 267.. 71
Wilson v. *Frank*, 173 F. R. 619..... 131
Winton v. *Lindsay*, 239 F. R. 521..... 12
Wisconsin v. *American*, 125 F. R. 761..... 131
Worden v. *Fisher*, 11 F. R. 505..... 144
Wright v. *Yuengling*, 155 U. S. 47..... 100

Yale v. *Berkshire*, 135 U. S. 342..... 65

IN THE

United States Supreme Court,

OCTOBER TERM, 1923.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner-Defendant.

v.

FRANK A. SEIBERLING,
Respondent-Plaintiff.

No. 185.

BRIEF FOR PETITIONER.

Statement.

This case comes up on Writ of Certiorari to the Circuit Court of Appeals for the Third Circuit.

It is a patent suit in which the Circuit Courts of Appeals for the Sixth Circuit and Third Circuit (Judge Davis dissenting) have respectively held that the same claims of State patent No. 941,962, dated November 30, 1909, for a Tire Making Machine, are invalid and valid. The patent has been held invalid on the full record by four Circuit Judges and one District Judge. It has been held valid by two Circuit Judges. The original decision of the District Court in the Sixth Circuit is of no moment because that Judge did not have the most important prior patent before him.

For the purpose of clearness, the Petitioner will hereinafter be referred to as Defendant, and the Respondent as Plaintiff.

The subject matter is a machine for making the outer shoes or casings of pneumatic automobile tires, which casings are mainly composed of fabric treated with rubber.

So Called Hand Making of Tires.

Although tires are, for convenience, referred to as "hand made" and "machine made", there is in reality no such clear distinction. Hand and machine are used in making both kinds, although the hand receives somewhat less assistance from machinery in the former case than in the latter. The large participation of the hand in the so-called machine operation is explained *infra*, p. 45. The hand operation has been described by the Sixth Court of Appeals and this description adopted by the Third Court of Appeals (Vol. II, p. 404) as follows:

> "An annular metallic core having spokes and a hub was centrally mounted upon a shaft so that it could revolve, the core thus resembling the rim or tire of a wheel. This core was approximately circular in cross-section, and its cross-section diameter as well as its entire diameter through the hub from edge to edge of the rim were proportioned according to the size of the casing to be made. The operator coated this core with an adhesive substance. He then took a strip of rubber-impregnated fabric which would stretch out to be as long as the circumference of the core, and in width somewhat less than the circumference of the cross-section. As he revolved the core on its hub, he stretched and pasted this fabric strip upon the core, pressing and shaping it with

his fingers or with hand tools, so that it adhered in all places and was without wrinkles. He repeated this operation as many times as there were to be fabric layers in the casing. The impregnating composition, having the character of rubber, would also attach each two layers of the fabric together. The strip of fabric was cut upon the bias, and the warp threads therefore ran from the inner open edge of the tube in a diagonal course along, across and around the tube to the other open edge thereof, and the next layer of fabric put on was reversed so that these warp threads crossed those of the first layer at a selected angle. Where the ends of the fabric met each other, they were overlapped enough to make a pasted joint. Each layer of fabric was first pressed down and attached by the hand of the operator on its central portion throughout its length, thus constituting the part of the casing corresponding to the tread. The degree of lateral curvature here is slight, and there would be no difficulty in making a smooth attachment, but as it was continued around the remaining circumference of the cross-section, there would be an obvious tendency to gather and wrinkle. This wrinkling would be fatal to the strength of the casing and it could be avoided only by careful manipulation and gradual shaping. The ultimately smooth and unwrinkled surface could be had by virtue of a quality which all woven material has had since weaving was known; *i. e.*, that it will contract in one direction, as it stretches in another. When a fabric is stretched in one diagonal direction, its square meshes become diamond-shaped with the length of the diamond along the line of stretch and its width at right angles. This produces a contraction of the fabric in the line of its width. In tire building, it is primarily the central part of the strip which is thus stretched longitudinally as it is attached to the tread of the core, leaving the side portions or wings projecting

> and free. Upon the same principle, if these side portions are then stretched laterally, they will shrink longitudinally, and, if this stretching is done in progressive measure as the edges are approached, the longitudinal shrinkage will be greatest at the edge. In this way, it results that the fabric may be shaped smoothly and without wrinkles to the entire side core surface."

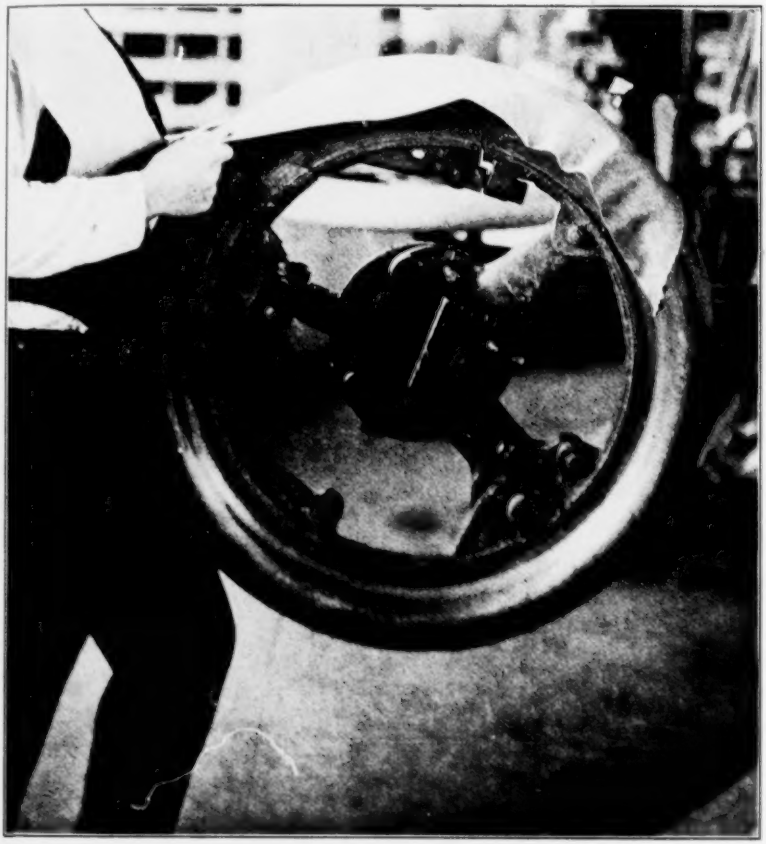
Other descriptions of the hand process are included in the testimony and referred to *infra*, page 89, *et seq.* The operation of stretching the fabric on the core is illustrated in the two adjacent half tones, the first one showing the workman initially stretching the fabric in a circumferential direction, and the second one showing the condition of the fabric after it has been circumferentially applied to the core.

In laying the skirts or edges of the fabric down smoothly on the sides of the core, the workman rotated it rapidly by hand (Vol. I, pp. 107, 117, 127, 137, 147, 153, 194, 286, 294). This rotation caused the loose skirts or edges to fly out under the influence of centrifugal force, until they stood substantially at a right angle to the plane of rotation (*id.*). About a dozen witnesses testified to this. Examples are as follows. Heller said (Vol. I, p. 117, Q. 21):

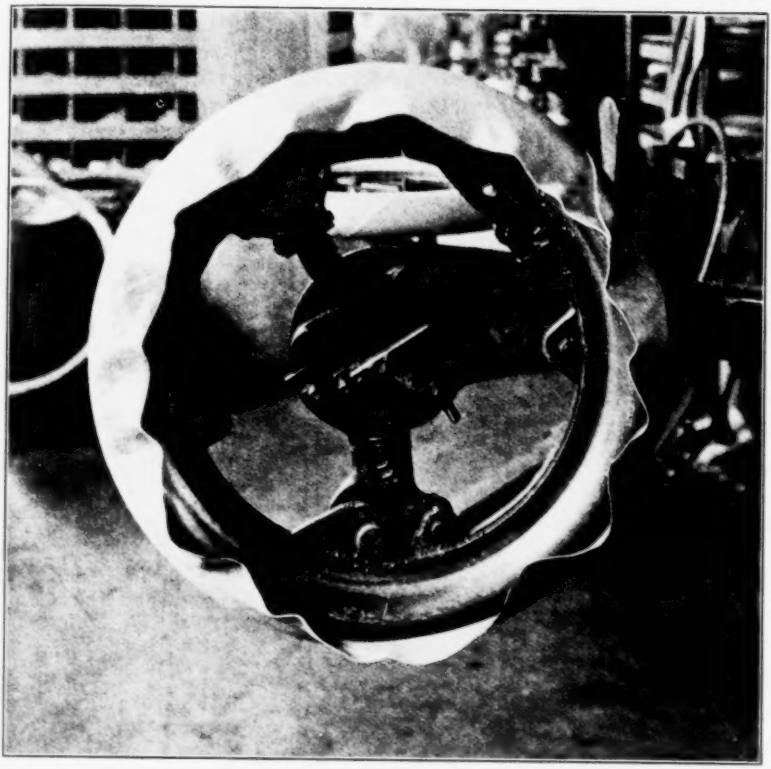
> "Q. 21. When the core was spinning fast, what position did the edges of the fabric take?
> "A. Straight out."

and Stark testified (p. 127, Q. 18):

> "Q. 18. When the core was spinning fast, what position would the edges of the fabric take?
> "A. Well, the faster you would spin the core, the fabric would stand out like this,—right out straight from the core."



Initial Stretching.

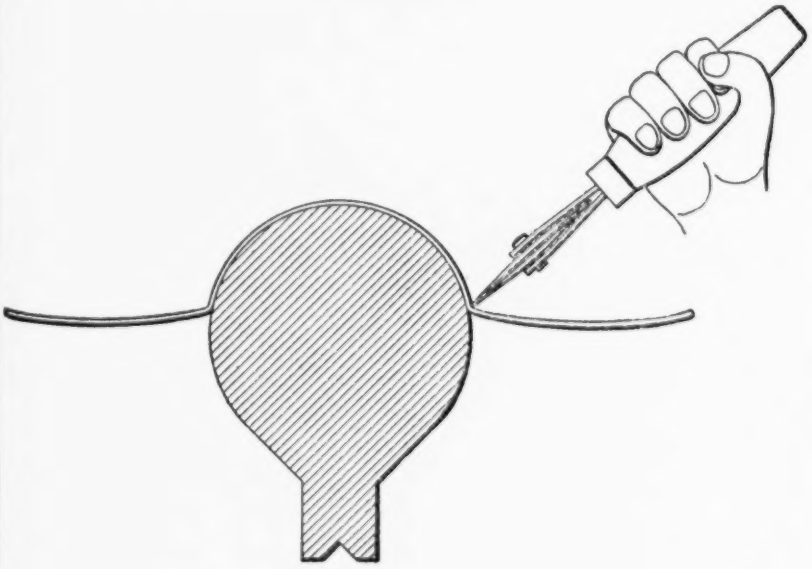


Fabric Circumferentially Stretched on Core.

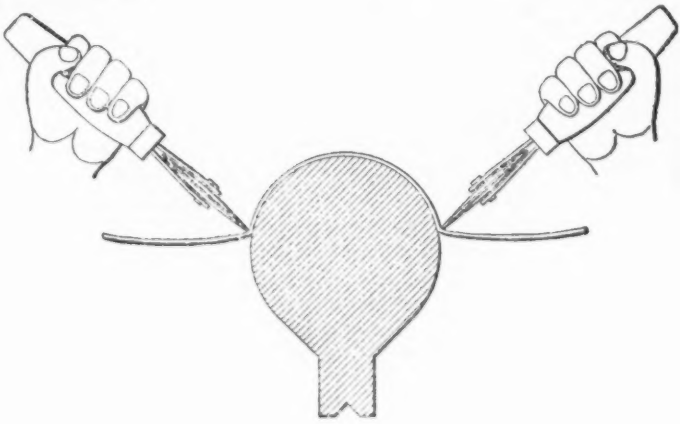
and Gregg said (p. 147, Q. 14):

> "Q. 14. When the core was spinning, what position did the edges of the fabric take?
> "A. Why, ordinary stand straight out, flare out."

The workman then took in his hand or hands a tool, commonly referred to as a "stitcher", or "spinning roll" which consisted of a steel disc two or three inches in diameter, rotatably mounted in a handle (*id.*). While the core was rotating at high speed, the workman placed the edge of this stitcher disc firmly against the fabric on the core at about the point where the fabric ceased to adhere, and pushed it slowly inwardly in a radial direction while holding it at a receding angle (about 45°) to the plane of rotation of core, as illustrated below where the core is shown in section (*id.*).



The result of this movement, in connection with the high speed rotation of the core, was such that the stitcher disc traversed a path consisting of close spirals on the side of the core, and thus gradually formed the skirt of the fabric smoothly thereon, the pressure of the tool and adhesive nature of the rubber compound causing the fabric to stick to the core. This operation was repeated on the other side of the core so that the entire strip was smoothly laid on and caused to adhere to the outer surface of the core (*id.*). If necessary, the workman gave the core an additional spin with his hand in order to cause it to retain its fast speed rotation throughout the operation, and some workmen would continuously rotate the core with the left hand while holding the stitcher tool in the right hand. Some workmen used two spinning rolls, one in each hand, so as to form the fabric on both sides of the core at once (Vol. I, p. 194). See cut.



And the core was, on occasion, rotated by a power belt (Vol. I, p. 148, p. 176).

The position taken by Plaintiff makes it unnecessary to describe the remaining operations in making the tires.

Upon the testimony in this case, the method just described was commonly followed in the hand building of tires prior and subsequent to the introduction of machines. It is called the "Hand Spinning Method". A very good general description of this practice is given by the president of the Hood Tire Co. (Vol. I, pp. 192-195). It is still employed at the Goodyear plant to supplement the operation of the State machines, because the latter only spin the fabric part way down on the sides of the core, leaving the last 30 or 40 per cent. of the operation to be performed by hand (Vol I, p. 234; Vol. II, p. 191, photograph).

State Patent in Suit.

(Vol. II, p. 1.)

The machine of this patent is described by Defendant's expert, Waterman (Vol. I, p. 212), but a brief review of the same here may be helpful.

Plaintiff says the product of this machine is the same kind as hand made tires (Vol. I, p. 395, Q. 59). The principal mechanical elements used are the same in both cases. Thus (referring to Fig. 2 of the patent drawings) the State patent shows a core 115 rotatably mounted on a stand 61. Rolls 147 are mounted in handles 140 to constitute tools like the hand stitchers already described. They are mounted on a part 131 which can be fed by screw operated by a hand wheel 124 inwardly along the side of the core, and are provided with springs

145 (Fig. 9) which press them laterally toward the sides of the core; thus simulating the hand operation of the tool. While the patent describes two spinning rolls arranged to operate on opposite sides of the core, all the claims in suit are limited to a single roll.

The mode of operation which Plaintiff's expert attributes to the State patent may be adopted for the present purposes (without conceding its accuracy) because it has been accepted by the court below (Vol. I, p. 39).

> "The machine of the State patent in suit is so organized and constructed that a previously unshaped, flat fabric strip from a supply or stockroll is uniformly stretched at its middle or tread portion upon a ring-core when rotating at the power-driven slow speed. After this middle or tread portion has been applied, the ring-core is rotated at high speed by the power-drive mechanism of the machine. During this high speed rotation, the fabric is shaped and applied to the ring-core beyond the tread portion at each side. The effect of the high speed of the ring-core is to throw out from its sides by centrifugal force the unapplied fabric portion. The forming- or spinning-rolls are carried by a support which is so mechanically mounted and fed as to ensure its radial movement with a gradual progressive advance in proper relation to the fast rotating ring-core. The forming- or spinning-rolls are pressed against the ring-core during such gradual radial advance, so that each spinning-roll acts gradually upon the centrifugally thrown-out fabric, thereby shaping it to the side of the rotating ring-core while bringing the fabric into adhesive contact therewith."

Apparently no machine like the patent in suit has ever been built, although the Plaintiff has ap-

proximated that in his Exhibit 2. His expert says that this exhibit is an operative and satisfactory machine, but although repeatedly requested on the record to do so, *Plaintiff's counsel refused to operate this machine in the presence of defendant's counsel and expert* so that testimony could be given on behalf of Defendant with respect thereto (Vol. I, p. 172; pp. 501-503). Apparently counsel for Plaintiff realized that this was unusual, for he stated that the "sole reason" for not exhibiting this machine in operation was the inability to obtain the proper power in the loft where it was located in Barclay Street, New York City. This also is a very unusual excuse, but we need not dwell upon it since Plaintiff's second expert, Ray, produced and put in evidence three tires which he says were made on the said machine, while it was in the loft in Barclay Street and driven by the electric power there (Vol. I, p. 582, xQs. 232, 236). This matter cannot be emphasized too strongly because, throughout Plaintiff's brief below, this machine was referred to in the most laudatory terms (*e. g.*, p. 44), where it was called "one of the most remarkable commercial machines of modern times". This and many other similar statements in the brief are unfounded in fact. We do not credit for a moment the assertion that commercial tires had been made upon this machine, except when it was in a greatly altered condition so as to correspond with the so-called Goodyear commercial machines, and feel that there could be no greater support for our contention than Plaintiff's repeated refusal to operate this machine in the presence of Defendant's representatives. Shaw, who was said to have operated the machine for Plaintiff's expert, did not testify (Vol. I, p. 582). The model produced by Plaintiff

is not a reproduction of the machine of the patent in suit.

A large number of machines have been manufactured and leased by Plaintiff, and have gone into extensive use because of their rapid operation although their work is far from perfect. But these are not the machines of the State patent (Vol. I, p. 230). The differences need not be all rehearsed here, but it should be said that the low and high speeds of rotation of the core are 8 and 120 instead of 6 and 207 required by the patent (Vol. I, p. 231); the lateral pressure on the spinning rolls is substantially wholly manual instead of spring (Vol. I, 232); and the fabric is shaped to the tread portion of the core by the original circumferential stretching instead of by the tread forming roll 141 of the patent (Vol. I, pp. 230, 231). See *infra*, p. 73 *et seq.* As shown by Plaintiff's Exhibit photographs (Vol. II, pp. 189, 191) and by Waterman's testimony (Vol. I, pp. 232, 233) the machines do not have the tread roll, bead applying rolls, and trimming mechanism mounted on the turn table slide, as shown and described in the patent. The tread roll is mounted below the slide and arranged to be operated by a foot treadle so that it can be used simultaneously with the spinning rolls. A large part of the fabric is spun down by hand. The beads are applied by bead placing rings as shown in Defendant's patent (Vol. II, p. 36), and the trimming is done by hand. These machines which were leased also embody features covered by important claims of the patent (*e. g.*, 1, 2 and 3) which are not in issue, and the validity of which has never been disputed. The structure and mode of operation of the commercial machines are strikingly different from the patent.

Further than this, the machine shown and described in the patent in suit is actually inoperative, as explained by Defendant's mechanical engineer witness, Waterman (Vol. I, pp. 215-222). Plaintiff realized this difficulty and went into the same on his *prima facie* case, calling a second expert, Ray, in support of his chief expert Browne (Vol. I, p. 87 *et seq.*). He further occupied pages 543 to 561 of Volume I of the Record and pages 158 to 190 of the Exhibit Book (Vol. II) with testimony and exhibits supplementing the disclosure of the patent in suit in the effort to remedy its deficiencies and mechanical inaccuracies. This emphasizes the work which had to be done in addition to the disclosures of the patent, before any commercial success whatever could be attained.

Plaintiff testified that the commercial machines still embody his so-called "State combination", even though changes have been made. He said that they still included the advancing table or slide, the arms mounted thereon, the stitching (spinning) rolls on the arms, means for imparting lateral pressure to the arms, means to cause the rolls to traverse the core radially, high and low speed devices and speed changing mechanism (Vol. I, p. 398, Qs. 91-93). But this combination of elements has been unqualifiedly cancelled from the patent by the Disclaimer, as forming *no part of State's invention* (see *infra*). There is not a word in this testimony of Plaintiff to show that the commercial machines include the limitations attached to the claims of the State patent by the Disclaimer. Hence, these machines are not covered by the State patent as it stands, and can be of no effect in supporting its validity (Vol. I, p. 412, Rd-Qs. 201, 202).

In view of the foregoing, there is no proper basis

for Judge Buffington's repeated references to the commercial success of the patented machine, and there is no force to the evidence by Plaintiff that he has continued old leases or issued new ones (both on a modified basis since January, 1919), because these agreements, Plaintiff's Exhibit 16, make no reference to the Disclaimer, and there is nothing to show that this Disclaimer was ever brought to the attention of any of these parties, or that any of these agreements were executed after the Disclaimer. Furthermore, they include the Seiberling & Stevens patent, as well as the State (Vol. I, p. 404). Commercial success can have no weight in support of validity except when it relates to the very machine of the patent as distinguished from some modified structure. *De Mayo* v. *Michener*, 231 F. R. 736, 737 (C. C. A., 2); *Johnson* v. *Lambert*, 234 F. R. 886, 889 (C. C. A., 2); *Winton* v. *Lindsay*, 239 F. R. 521, 526, 527 (C. C. A., 6); *Fielding* v. *Crouse*, 154 F. R. 377 (C. C. A., 2).

It is difficult to understand why Plaintiff lays so much stress on commercial success, and why this has also been adopted by Judge Buffington, who says that the public would not have acquiesced in the patent unless they believed it to be valid (Vol. II, p. 413). Assuming this to be so, what weight can this belief have when it is now formally admitted by the Disclaimer that the patent was void and the belief, therefore, unfounded?

Specification of Errors.

The Writ of Certiorari brings up the entire decision below for review and the alleged errors include failure to sustain any of the defenses listed below and hereafter discussed.

Defenses.

The Answer raises all the customary defenses, but those which are mainly relied upon are the following:

1. Anticipation of the *method* of State patent by hand spinning (*supra*, pp. 2-7 and *infra*, 87-104).

2. Anticipation of both apparatus and method of State patent by the Belgian and other prior patents (*infra*, pp. 19-34 and 106-136).

3. No invention in operating a known machine as in hand spinning (*infra*, pp. 43-49).

4. Invalidation of State patent by the Disclaimer (*infra*, pp. 53-87).

5. Invalidation of State patent because State was not the sole inventor (*infra*, pp. 138-144).

6. Non-infringement (*infra*, pp. 145-157).

Of the above defenses there are two which could not be raised on the Record in the Sixth Circuit case, hereinafter called the *Firestone* case; to wit: the invalidating of the patent by the Disclaimer filed since the decision in the *Firestone* case, and that State was not the sole inventor of this patent. Inasmuch as Plaintiff no longer relies for novelty upon the mechanical structure recited in the claims, it is unnecessary to take up the defense of aggregation.

In order to avoid any misunderstanding, it should be stated at the outset that Defendant does not contend that a patent cannot be granted for a machine which carries out a method or process previously followed by hand. Indeed, some of the

most valuable patents are in this class (*Hildreth* v. *Mastoras*, 257 U. S. 27). But, in such cases, the patentable invention must reside in the machine itself, not in the method it follows. As said by this Court, in the cited case:

> "The ultimate effect of this step with the *mechanical or patentable* improvements of his device was to make candy-pulling more sanitary, to reduce its cost to one-tenth of what it had been before him, and to enlarge the field of the art." (Italics ours.)

What we do contend is that a machine patent which is anticipated by another machine patent, cannot be validated by construing it as for a method when that method was previously performed by hand. In the first place, it is unlawful so to construe a patent; and in the second place, the method itself is old, since a method is the same whether it be followed by hand or by machine.

Brief History of the Sixth Circuit Case.

In 1914, Plaintiff filed Bill of Complaint against Firestone Tire & Rubber Co. (in Ohio), charging infringement of claims 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 22, 23, 24, 25 and 26 of said State patent, and of claims 1, 2 and 14 of a Seiberling & Stevens patent, No. 762,561, June 14, 1904. The *Firestone* case was tried before Judge Killits. He found all the said claims of both patents to be valid and infringed (234 F. R. 370). Firestone appealed to the Court of Appeals for the Sixth Circuit and the case was argued in that Court (Warrington, Knappen and Denison, *JJ.*). While the Court had it under consideration, Firestone discovered an important prior patent which had not been presented to Judge

Killits. This was a Belgian patent to Matherne, dated September 20, 1906. Motion to reopen to permit proofs with respect to the Belgian patent was granted, and the Court of Appeals ordered the case remanded to the District Court unless the parties otherwise disposed of the matter by stipulation (245 F. R. 937). Thereupon a stipulation was made and approved by the Court of Appeals, by which the Belgian patent and explanatory affidavits were incorporated in the record before that Court. The case was re-argued, and a decision was rendered on December 13, 1918, in which all the said claims of the State patent and claims 2 and 14 of the Seiberling & Stevens patent were held invalid, while claim 1 of the latter patent was held not infringed. The opinion is printed as an appendix hereto.

The Court of Appeals recognized that Plaintiff really presented his case on the theory that State had discovered a new *method* of making tires and, in order to make its decision in the *Firestone* case comprehensive, that Court considered the State patent as if it were for a method, and held that it was anticipated by the identical method previously performed by hand.

The Court further found that the Belgian patent, under any reasonable theory of its operation, disclosed this same spinning method.

It was also held that the machine of the Seiberling & Stevens patent had been used for a similar spinning operation in making tires before State's invention; and that a Moore patent showed essentially the same operation. Therefore, the Court came to the conclusion that

> "State cannot be considered as the inventor of the method" (257 F. R. 84).

Plaintiff made no attempt to attack this decision of the Sixth Court of Appeals. He filed no Petition for Rehearing and no Petition for Certiorari. In fact, he acquiesced in the decision and sought to avoid it by Disclaimer.

Brief History of the Third Circuit Case.

The Bill in the present case was also filed in 1914, but in the District of New Jersey. After the decision in the Sixth Circuit (Dec. 13, 1918), Plaintiff filed in the Patent Office (Feb. 15, 1919) a Disclaimer with respect to the State patent, whereby he sought to change it from a machine patent to a method patent; and the case then went to proofs. The case was fully heard by Judge Bodine and he, in a memorandum opinion (Vol. II, p. 399), found that the method or process which the Disclaimer had read into the patent was the same as that which the proofs showed had, for many years prior to State's patent, been used in making tires by hand. The District Court also noted the fact that the Sixth Circuit Court of Appeals had considered the State patent as though before it in its present aspect, *i. e.*, as changed by the Disclaimer. Having found that the method read into the patent by the Disclaimer was old, and that the Sixth Court of Appeals had come to the same conclusion, and, after citing *Conroy* v. *Penn.*, 155 F. R. 421 (Aff. 159 F. R. 943), to show that a machine patent cannot be sustained as for a method when that method was old in hand work, Judge Bodine found that it was unnecessary to pursue the many other grounds urged for the invalidity of the patent.

On appeal, the majority of the Court below held that the State patent disclosed a new method or "process" which was "wholly different from the original hand process"; that the Belgian patent disclosed "a procedure wholly different from State"; that the machine of the Seiberling & Stevens patent was "of wholly different type" from the machine of the patent in suit; and it failed to mention the Moore patent. The majority of the Court also held the Disclaimer to be valid and proper under the Statute. (Vol. II, p. 403.)

Judge Buffington's statement that the record in the Third Circuit was "substantially different" from that in the Sixth Circuit should be considered in the light of the fact that the Sixth Circuit record was not presented to the Third Circuit Court, so that there was no opportunity for comparison. Actually, Plaintiff's contentions were the same in both cases.

In the dissenting opinion (Vol. II, p. 415), Judge Davis found that the Sixth Circuit Court of Appeals had held that there was nothing new in the method attributed to the State patent. He held that the Disclaimer set forth a method of operation which was a disinct addition to the claims and that, to a certain extent, the character of the patent was changed by it to a method patent. He held that this could not be done by Disclaimer and that the patent was invalid.

Plaintiff's Change of Front.

In the *Firestone* case, Plaintiff laid stress upon his Seiberling & Stevens patent of June 14, 1904. His brief (p. 5) said it "worked industrial revolution"; it was asserted to be the first satisfactory machine for performing certain functions, and, it was emphasized that the brief use of that machine was due to financial reasons alone.

Judge Killits adopted this contention and praised the Seiberling & Stevens patent, stating that he had seen an exact reproduction of the same in operation, considered testimony as to the product thereof in practical use, and that the patent "was decidedly an advance step in the art and so far occupied the field that it anticipated, in a large measure", the State invention (234 F. R. 371).

The Court of Appeals for the Sixth Circuit, while not giving such approval to the Seiberling & Stevens patent, sustained one of its claims; said that it was a machine "of the same general type as State's" (257 F. R. 80), and explained how it largely anticipated the State patent (257 F. R. 83).

When, after the decision in the *Firestone* case, Plaintiff proceeded against Defendant in the case at bar, the Seiberling & Stevens patent had come near to the end of its term, so that it seemed expedient for Plaintiff to rest his case most heavily upon the State patent, which would not expire until five years later. In carrying out this plan, Plaintiff abandoned any efforts to obtain a decree in this suit under the Seiberling & Stevens patent (Vol. I, p. 91), and transferred all his praise to the State patent, asserting that it was the

first machine to do the very things which he had, in the *Firestone* case, asserted the Seiberling & Stevens machine had done four or five years previously; and maintaining that the efforts to use the Seiberling & Stevens machine "had signally failed" (Brief below, p. 43). Of course, Plaintiff could not personally contradict his testimony in the *Firestone* case, but he supported this strategem by eliminating from his testimony all reference to his Seiberling & Stevens patent or machine which he had praised in his testimony in the *Firestone* case; and by having State refrain from mentioning his own patent when testifying in this case. This effectively shut off any cross examination of Seiberling with respect to the Seiberling & Stevens patent and any cross-examination of State with respect to the State patent. A further step was to have State testify in the case at bar that the Seiberling & Stevens machine was no good, while Seiberling praised the State machine. Plaintiff carried this plan so far that there is not a word in State's entire deposition to show that he is the State named in the patent. The leading and calculated form of the introductory question put to State is significant (Vol. I, p. 303):

> "Q. You are the originator of the Goodyear commercial machine for the manufacture of fabric carcasses for tires, are you not?
> A. I am."

The positions taken by Plaintiff in the two cases cannot both be true, and we should suppose that such inconsistencies with respect to fundamental facts lying particularly within the breasts of Plaintiff and his witness would discourage the giving of

full credit to the uncorroborated testimony of Seiberling and State in the present Record.

In the following pages we shall endeavor to show that the views of the Court of Appeals for the Sixth Circuit, of Judge Bodine, and of Judge Davis were correct, and that those of the majority of the Court below were erroneous.

At the outset it should be noted that the Court of Appeals for the Sixth Circuit saw the machines in operation; *i. e.*, the machine which Plaintiff contended represented the State patent; the machine which Plaintiff contended represented the Seiberling & Stevens patent; the machine which represented the Belgian patent; the machine which represented the Moore patent, and the apparatus used in the previous hand making of tires. We emphasize this point because the Court of Appeals for the Third Circuit did not have a demonstration of any of these machines or methods.

Brief Recital of Prior Art.

It may be of assistance at this juncture briefly to recite the main developments in the art prior to State.

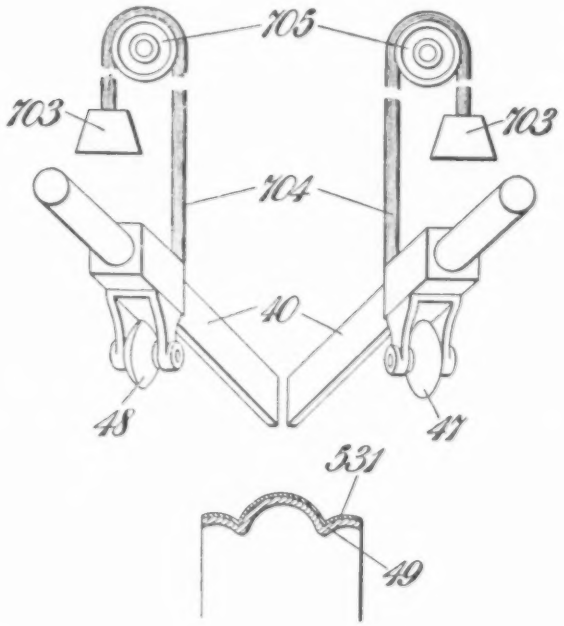
The hand spinning method has already been described so that it need not be repeated.

Turning to machines disclosed in prior patents, we find that an early entrant in the field was the

Moore Patent of 1894.*

(Vol. II, p. 273.)

The following cut represents, somewhat diagrammatically, the pertinent portions of this apparatus, with the core shown in section.



The core 49 was arranged so as to be expanded and contracted. The fabric 531 was placed upon the core in the form of an endless band while the core was contracted, and the latter was then expanded so as to circumferentially stretch the fabric. After this operation, the fabric was smoothed and stretched by a series of rollers, two of which are

* For more complete discussion see page 135 *et seq.*

shown, the one marked 47 being a spinning roller, and the one marked 48 being a creasing roller.

Each of these rollers is mounted on a lever 40 which is freely pivoted at its rear end and has a handle at its forward end so that it may be grasped by the operator and pulled downwardly in order to cause the roller it carries to pass along in contact with the fabric on the core, by a combination of radial and lateral movements. The patent says:

> "The described mode of connecting the levers with their support enables the said levers to be moved freely up and down as required, and to be slid laterally as may be desired in order to bring the required one thereof over the working points on the expansible former [core]." (Vol. II, p. 280, line 76.)

The weights 703 attached to cords 704 that pass over pulleys 705 and are also fixed to the levers 40, serve to hold the levers and rollers out of the way when not in use.

During the operation of these rollers, the patent says:

> "the rotation [of the core] is kept up at a *high rate of speed*" (Vol II, p. 281, line 73),

and that the rollers 47 and 48 are

> "successively brought into action, smoothing and *stretching the said wings* [of fabric] into proper position and condition, the narrow roller [48] working into the angles of the shell [core]." (Vol. II, p. 282, line 24.)

The specification of the patent also says that the core

> "may be of any other desired and approved shape" (Vol. II, p. 280, line 106).

The patent is fully described by Defendant's expert, Waterman, beginning Vol. I, p. 257.

In the *Firestone* case the Court of Appeals said (257 F. R., at p. 83):

> "The Moore patent shows what is, essentially, a spinning roll for operating against a revolving core in making a tire casing. It was intended to and did smooth down the Moore tire from the center of the tread only part way, and not much further than may be done by the typical tread-forming roll; but the operation is substantially spinning, as far as it goes, and involves, in some degree, the characteristic relocation of the threads of the fabric, even though it may only put them back where they were before the casing was distorted by placing it on the core. In the Moore patent, the handle of the spinning roll was so attached to its frame that the roller could not effectively travel radially of its core down as far as the bead, but if its attaching staple is made larger, the whole tire can be formed thereby *as demonstrated*." (Italics ours.)

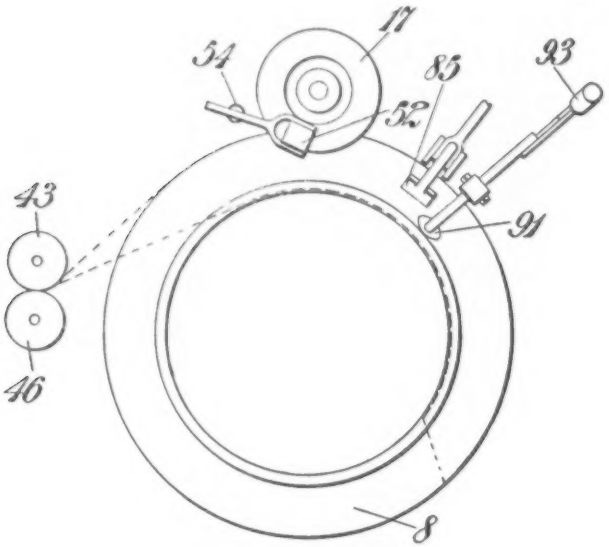
This patent has become very pertinent in the present case because of Plaintiff's contention that the Disclaimer (discussed *infra*) has changed the claims in suit so as simply to cover combinations of a high speed core and a spinning roll. Moore unquestionably shows this combination, and he not only describes the high speed of the core but he expressly refers to the action of the spinning rolls as *stretching* the wings or edges or skirts of the fabric into proper position and condition.

Seiberling & Stevens Patent of 1904.*

(VOL. II, p. 257.)

This is one of the two patents originally in suit and Plaintiff was one of the co-inventors. It was strongly relied upon by Plaintiff in the *Firestone* case, and one of its claims there sustained, but Plaintiff has not made a *prima facie* case upon it in the present suit.

The pertinent parts are fairly represented in the following cut.



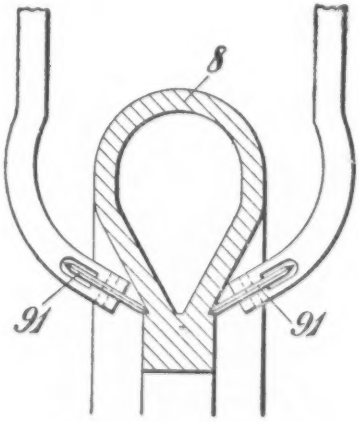
The core is marked 8, and is arranged to be rotated at high and low speeds by frictional contact with the power driven tread forming roll 17. The fabric, shown in dotted lines, is led from between stretching rolls 43 and 46, that are squeezed to-

* For more complete discussion see page 126 *et seq.*

gether like the rolls of a clothes wringer, in order to resist the movement of the fabric and thereby stretch it circumferentially as it is drawn onto the core during slow speed rotation. The tread portion is shaped by the roll 17, and the upper side portions by rollers 52, one on each side, which are drawn toward each other by a spring 54 and thus press firmly against the fabric on the core the edges of the tread roll 17, which are somewhat flexible.

The main side portions of the fabric are smoothed down on the core by jigger fingers 85 that are arranged to rapidly reciprocate in a radial direction and to be pressed laterally against the fabric on the core during the inward portion only of each reciprocatory movement. The patent says that these fingers "smooth out the wrinkles" (Vol. II, p. 268, line 126).

The extreme edges of the fabric are shaped to the core by a pair of stitching rollers 91, which are mounted so as to be moved radially and pressed laterally against the fabric on the core by the operator seizing the handle 93. These stitching rollers are well shown in the following cut,



Marquette Law Library

25

and it will be observed that they are mounted on arms and at a receding angle to the plane of the core, as described in the State patent. The pertinency of this part of the Seiberling & Stevens construction is emphasized by the fact that, in this suit, Plaintiff has charged that the forming rolls in Defendant's machine infringe a claim directed to these stitching rolls of Seiberling & Stevens and also infringe the claims of the State patent in suit.

Defendant's expert Waterman describes this patent beginning at the bottom of page 255 of Volume I.

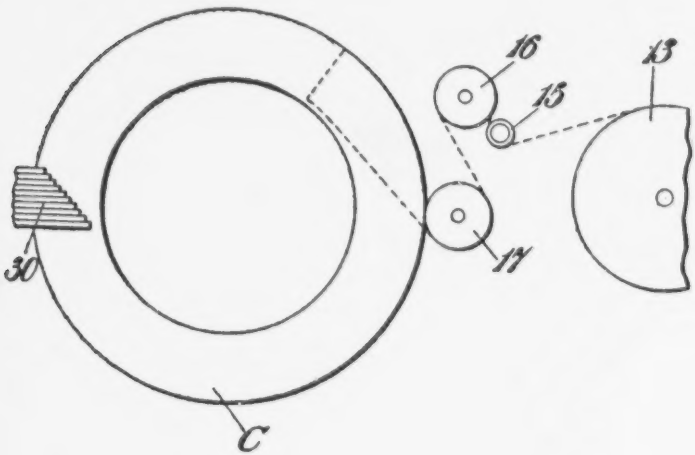
The Court of Appeals said in the *Firestone* case (257 F. R. 83):

> "The Seiberling and Stevens patent shows what it calls creasing or stitching rollers. Each one is undoubtedly an effective spinning tool and capable of use as such; their edges, as shown, may be sharp enough to cause some danger of cutting the fabric, but the spinning would be done by the side bevels, not by the extreme edge; and plaintiff's theory that defendant's spinning roll is so far the equivalent of the Seiberling and Stevens stitching rolls as to make out infringement of the claim based thereon goes far to persuade that they are, in a broad sense, an anticipation of State's spinning roll. There seems no sufficient reason to doubt that Stevens used them for spinning in 1903 or 1904."

Vincent Patent of 1905.*

(VOL. II, p. 245.)

The machine of this patent was in commercial use, both here and abroad, before State's (Vol. I, p. 187 *et seq;* pp. 388, 389). The following cut represents the important parts.



The core is marked C. There is a fabric supply roll 13 and guide rolls 15, 16 and 17 through which the fabric, shown in dotted lines, is led on its way to the core. These rolls are geared so as to resist the movement of the fabric, and the core is power driven in order to draw the fabric from the rolls and stretch it.

After the fabric has been stretched circumferentially on the core, its skirts or edges are formed down on to the sides by two sets of spring actuated hammers 30 which are arranged progressively in a

* For more complete discussion see page 130 *et seq.*

radial direction so that, as the core rotates, the fabric is tapped on to the sides thereof, the operation beginning at the outer portion of the side and extending progressively inward to the bead.

The patentee says that the machine is adapted

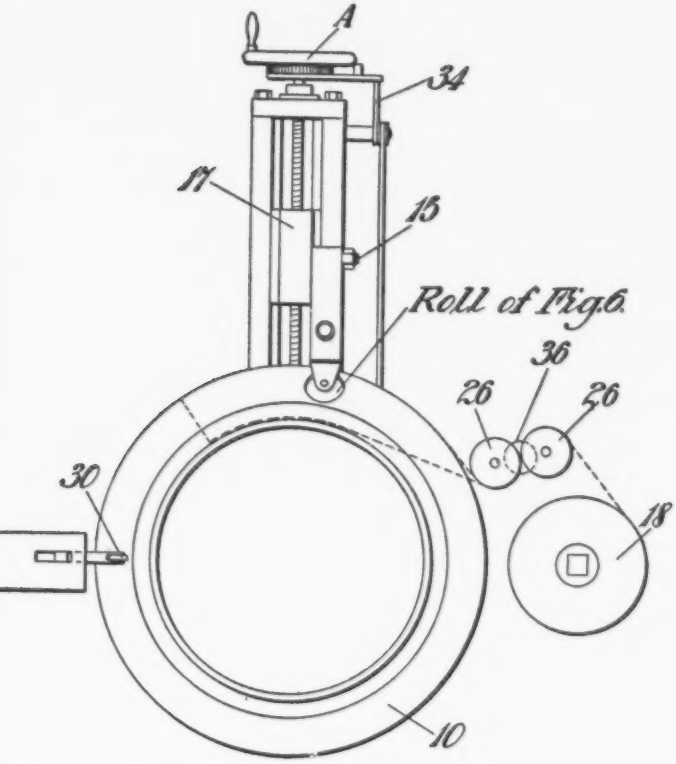
> "to shape and *stretch* the canvas layers exactly to the same amount whatever be their number, so as to permit the different elements of the tire to work equally" (Vol. II, p. 253, line 17).

When the State patent was pending as an application, claims corresponding to those in suit were rejected by the Patent Office upon this prior Vincent patent (Vol. II, p. 365), and the claims were only allowed and the patent granted because both State and Seiberling filed affidavits in the Patent Office to the effect that the Vicent machine had been tried and proved unsatisfactory (Vol. II, pp. 385, 389). These affidavits were not true, as is shown by the testimony of Raymond (Vol. I, p. 187); and the cross-examination of Seiberling (Vol. I, pp. 388, 401). The fact was that this Vincent machine had been in large and successful use by the B. F. Goodrich Company, and that Seiberling himself had found the same in use at the Pirelli plant in Italy, and had advocated that the Goodyear Company negotiate for United States rights.

Matherne Belgian Patent of 1906.*

(VOL. II, pp. 217-227.)

The main parts of this patent are shown in the following cut.



The core is marked 10 and is arranged to be power driven at both high and low speeds, the variations being effected by changing gears, as in the State patent, and the ratio of high speed and low being

* For more complete discussion see page 106 *et seq.*

about 20 to 1, which is intermediate that described in the State patent and that used by Defendant (Vol. I, pp. 245, 231, 277).

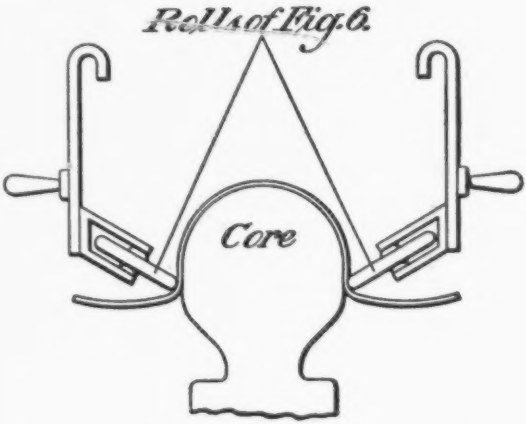
The stock roll for the fabric is represented by 18 and its rotation is resisted by a band brake (shown in Fig. 2 of the patent) so that the fabric, shown in dotted lines, will be stretched as it is drawn onto the core. The guide rolls are 26, and the fabric is passed around them on its way from the stock roll to the core. A pair of conical gears 36 are combined with the guide rolls in the effort to insure that the puckers formed in the edges of the fabric as it is stretched circumferentially on the core will be uniform (Vol. I, p. 247). These gears also necessarily serve to hold the fabric edges out laterally so that they cannot accidentally stick to the sides of the core while the fabric is being drawn thereon.

A pair of rollers 30 are arranged to be reciprocated on the sides of the core to stick the fabric at the central side portions.

A screw fed slide 17 is arranged to be moved radially of the core by the hand wheel A, (as in the State patent) or automatically (as in Defendant's machine) by the mechanism 34.

A pair of spinning rolls marked Fig. 6 are carried on pins 15 which project from the sliding carriage 17, whereby the spinning rolls will be fed radially of the core as the carriage 17 is moved by its screw, just as in the State patent. The handles on the spinning roll arms enable the operator to press them laterally against the fabric on the core during their inward radial movement, as is customary in the operation of the Goodyear (State) commercial machines, as well as in other commercial tire making machines (Vol. I, pp. 232, 134,

169). This operation is represented in the following cut.



It is perfectly feasible to omit the use of the reciprocating rollers 30, just as State can omit the use of his tread roller 141 (Vol. I, p. 513), and let the spinning rolls Fig. 6 apply the entire side edges or skirts of the fabric after it has been circumferentially stretched on to the core (Vol. I, p. 280). After describing how the fabric is originally stretched on at low core speed, the Belgian patent says (Vol. II, p. 220):

> "Then the speed of the machine is changed by clutching the cone 3 to the shaft 11 and moving aside the gears 5 and 6. On the support 17, which constitutes a tool carrier, there is mounted a tool like that shown in Fig. 6, which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 is adjusted so that the roller comes to the level of the top of the core. Then the machine is set in operation and the roller is caused to descend progressively on the side of the core and all the way down to its base. Thus there

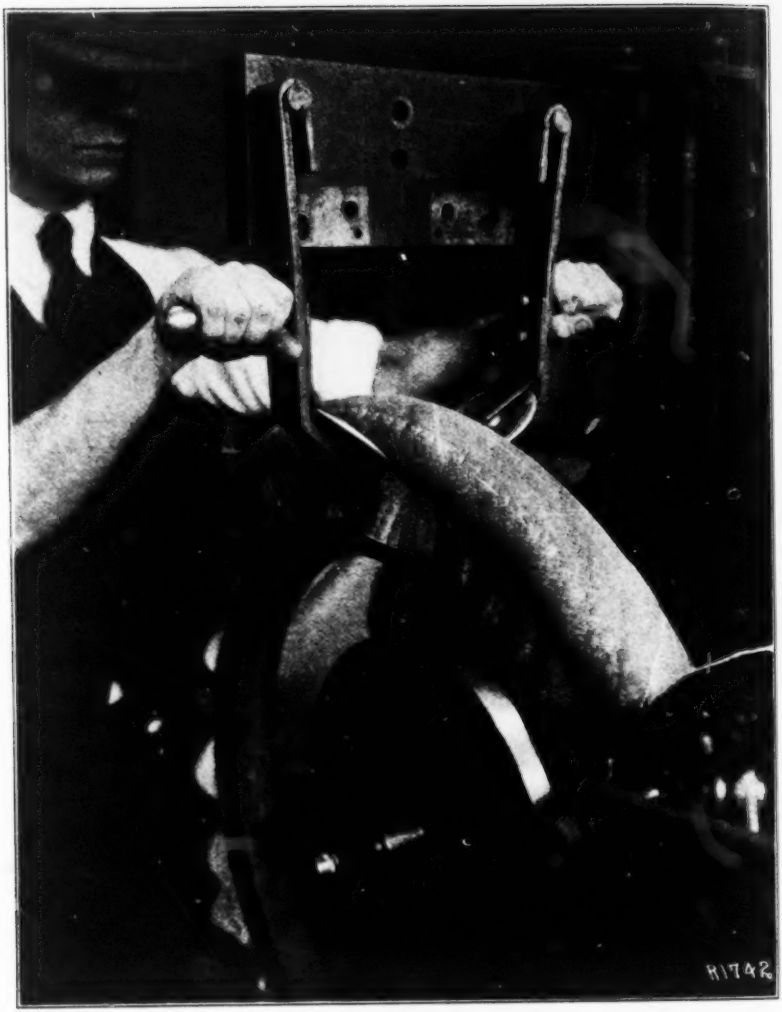
> is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34. Both sides may be readily worked at the same time, by mounting two tools like that shown in Fig. 6 on the sliding tool carrier 17."

And again he refers to this operation as (Vol. II, p. 221).

> "the principle of the roller descending progressively on the core during rapid rotation and producing a progressive removal from the fabric of the puckers by eliminating the puckers from the point of their origin, this being performed in a single descending movement."

Defendant's expert Waterman testified as follows (Vol. I, p. 252):

> "A. In my opinion it [the Belgian patent] discloses exactly the mode of operation practiced with the Goodyear [State] machines. Thus in both the fabric is stretched into partial conformation with the core and the tread portion rolled into intimate contact therewith. In each the fabric is pressed against the core by heavy pressure applied to the spinning roll and is thereby conformed and stuck to the core. The only difference is that the Belgian patent automatically feeds the spinning roll radially inward while the Goodyear machines were hand fed.
>
> "Q. 33. Does this Belgian patent disclose an open tire shoe making machine which has a power driven ring core, a radially moving support, and a spinning roll mounted on the support for passing radially along the sides of the tire shoe to shape the sheeted fabric on the core?
>
> "A. Yes.
>
> "Q. 34. Does it show the spinning roll as mounted at a receding angle to the plane of the core?



Photograph No. 10

"A. It does.

"Q. 35. Does it show the spinning roll as having a rounded disk shaped working edge?

"A. It does.

"Q. 36. Does it show a pair of such spinning rolls so mounted for simultaneous operation on both sides of the tire?

"A. Yes.

"Q. 37. Does it make provision for yieldingly forcing these spinning rolls laterally toward the core?

"A. Yes, the spinning rolls are pivoted to swing to and from the core and provided with handles for yieldingly pressing the spinning rolls against the core. These handles are shown in Fig. 6 placed down close to the spinning wheel so as to give a large leverage and enable a heavy pressure to be exerted.

"Q. 28. Does it show slow speed mechanism for actuating the core when receiving fabric from the stock roll?

"A. It does and expressly describes it for this purpose.

"Q. 39. Does it show fast speed mechanism for actuating the ring core during the operation of the spinning roll?

"A. It does and describes it for this purpose.

"Q. 40. Does it show speed changing mechanism for changing from the low speed to the high speed and the opposite?

"A. It does.

"Q. 41. Is the radially moving support which carries the spinning roll, in the Belgian patent, a radially sliding support?

"A. Yes, it is carried on a slide moving in guideways and is fed by a screw, as in the State patent, but in the Belgian machine the screw is fed automatically."

The sameness of the machine of the patent in suit and of the Belgian patent is well shown by reference to the opposite picture of the Belgian

machine in evidence (which has not been criticized as failing to be an exact embodiment of the patent) and the picture of one of the State commercial machines put in evidence by Plaintiff (Vol. II, p. 191).

This Belgian machine unquestionably infringes even the more limited of the claims in suit, considered as claims for a machine. Take, for instance, claim 12 which calls for

> a stock roll for carrying a strip of sheet fabric
>
> a ring core
>
> a slow speed mechanism for actuating the core when receiving fabric from the stock roll.
>
> a radially moving spinning roll for passing radially over the side of the tire shoe to shape the fabric on the core
>
> fast speed mechanism for actuating the ring core during the operation of the spinning roll
>
> speed changing mechanism.

Every one of these elements is shown and described in the Belgian patent. Therefore, the long established doctrine that that which infringes if later anticipates if earlier is applicable. In *Knapp* v. *Morss*, 150 U. S. 221, 227, this Court said:

> "the rule is well established that 'that which infringes, if later, would anticipate if earlier'."

To the same effect are *Miller* v. *Eagle*, 151 U. S. 186; *Peters* v. *Active*, 129 U. S. 530; *Thatcher* v. *Burtis*, 121 U. S. 286; *Grant* v. *Walter*, 148 U. S. 547; *Gordon* v. *Warder*, 150 U. S. 47.

This immediate proximity of the prior art requires that the State patent be

construed with strictness, rather than liberality; and discloses why Plaintiff has been forced to endeavor to have his machine patent construed as for a method, and even to file an elaborate Disclaimer in the effort to establish a basis for arguing validity.

Controlling Point of Difference Between Third and Sixth Circuits.

Judge Buffington's opinion assimilates the State method to the hand method down to a certain point. He says (Vol. II, p. 408):

> "He [State] continued that process just as it had been in the hand process, down to the point where he plastered or cemented the fabric on to the core down to the median line point."

From this point on Judge Buffington asserts a difference which is in conflict with the Sixth Circuit decision and which has no foundation whatsoever in the proofs or in the laws of physics. Judge Buffington's statement of this distinction is as follows (*id.*):

> "But here he [State] changed to something the old hand process had never used, namely, the machine was *speeded up* to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric *stretched itself radially* and thereby formed radial, diamond-shaped interstices, which contracted the normal length of the fabric. At this point we note that State made use of a shifting platform, on which he mounted on each side of the tire spinning wheels or rolls so pressed inwardly by springs that as the rolls revolved they engaged and pushed inward and against the sides of the core the *stretched* flying skirts of the fabric. Thereby he then, and by the wheels, pressed and cemented the *radially stretched*

> *and therefore puckerless fabric* against the lessening sides of the shoe clear down to the bead edge. It will therefore be seen that the essence of his disclosure was the rapid, sustained, regular revolution of his core, the use of a shifting platform on which he located his spinning rolls, and the constant regular and uniform exertion of pressure upon those spinning rolls, causing them to automatically press the *automatically stretched and loose fabric*, or skirts, in an *unwrinkled state*, on the bead of the lower surface of the core." (Italics ours.)

Judge Buffington here asserted differences between the State mode of operation and the hand operation in direct opposition to the statement of the Sixth Court of Appeals (257 F. R. 83), quoted below. The Sixth Circuit was correct in finding no difference between these two modes of operation and Judge Buffington was wrong in holding the contrary.

The points of difference in mode of operation which Judge Buffington asserts are as follows:

> 1. That State "speeded up" the core as compared with the speed in hand operation. We will later show that this is unsupported by and contrary to the proofs (*infra*, p. 99).
>
> 2. That the "speeded up" core produced so much centrifugal force that the loose fabric "stretched itself radially". We will show later that this is unsupported by and contrary to the proof, as well as contrary to the laws of physics (*infra*, pp. 93-98).
>
> 3. That the "spinning wheels" acted upon fabric which was "radially stretched and therefore puckerless". We will show later that this is unsupported by and contrary to the proof (*infra*, p. 125).

If we show that Judge Buffington was wrong in all three of the above suppositions and that the Sixth Circuit was right, it will totally undermine Judge Buffington's disagreement with the Sixth Circuit, and will re-establish the fact that there was no distinction in process or mode of operation between State and the old hand method. The mode of operation being old, we also show that the only apparatus to which Judge Buffington refers (*viz.*, "the shifting platform on which he [State] mounted" the spinning rolls) was old, both reciprocating and swinging, for the support of spinning rolls and fabric forming fingers, in the prior patents to Matherne, Seiberling & Stevens, and Moore (*supra*, pp. 21-35).

Judge Buffington in his opinion repeatedly expresses the same erroneous supposed distinction as follows:

> "the rapid rotation of the core and the consequent exercise of centrifugal force on the covering material by which it is automatically gradually stretched radially" (Vol. II, p. 407);
>
> "the crux and dominating functional feature of State's machine is the use upon the fabric of a centrifugal force caused by rapid rotation, a process which is wholly different from the original hand process" (Vol. II, p. 408);
>
> "the automatically stretched and loose fabric, or skirts" (*id.*);
>
> "the utilization of centrifugal force to stretch the fabric" (Vol. II, p. 411);
>
> "a centrifugally automatically stretched fabric" (*id.*);
>
> "stretched those fabric edges into radial diamond shaped interstices by the use of high speed core rotation" (Vol. II, p. 413);

"We have the loose edges, stretched by centrifugal force induced by rapid core rotation" (Vol. II, p. 414);

"the gist of which is the rapid rotation of the core and its resultant radial stretch" (Vol. II, p. 411);

"the stretched flying skirts of the fabric" (Vol. II, p. 408);

"the radially stretched and therefore puckerless fabric" (*id.*);

"utilizes the rapid rotation to enable the rolls to plaster an unpuckered radially distended diamond shaped fabric upon the core" (Vol. II, p. 411).

This constantly repeated supposed distinction that centrifugal force is utilized in State and is not utilized by the hand method to stretch the skirts preparatory to being acted upon by the spinning tools, is the distinction upon which the majority in the Third Circuit rest their opinion. This is directly opposed to the unanimous finding of the Sixth Circuit which was that there was no difference between the method of State and the old hand method. The unanimous opinion of the Sixth Circuit was stated as follows (257 F. R. 83):

"The evidence that this *identical* spinning operation was performed upon tire casings by hand tools before State's invention is sufficiently satisfying to meet all the requirements of the situation. (Italics ours.)

* * * * *

"Messrs. State and Seiberling were called as witnesses on the rebuttal; both were familiar with the history of the art; neither one denied or questioned this proposition; nor did any other witnesses for plaintiff. More than this, State, in his specification, speaks of this spinning operation as if it were well-known hand practice, and seems to rely upon the advantages of his tool over the existing hand method."

The condition of the testimony of these witnesses on this point is exactly the same in the instant case. Neither State nor Seiberling, nor plaintiff's experts, Browne or Ray, nor the practical Goodyear men, Bedell, Rowles and Price, made any pretence that the State machine method differed from the hand method or that there was any stretching of the skirts by centrifugal force. Defendant's expert, Waterman, had stated positively that there was no difference between the two methods and, if he had been wrong in this regard, the above named witnesses of plaintiff in rebuttal would certainly have so stated. Mr. Waterman's testimony was as follows (Vol. I, p. 234):

> "The method used by the operator when I saw him operating the machine [State's] was the customary procedure of hand building of tires * * * The spinning roll therefore was caused by the workman to act exactly as in hand spinning."

Indeed, the State patent itself says (Vol. II, p. 19, line 113), referring to the springs which press the spinning rolls toward the core:

> "These springs exert the pressure against the fabric for forming it against the sides of the core which would be exerted by the arm of the workman in case of a hand-tool or a hand-pressed roll."

Nowhere does the patent suggest that there is any difference between the machine method and the hand method.

No stretching of the skirts is attributed to centrifugal force in the Disclaimer or in the State patent.*

---

* The patent does not mention radial stretch as being produced by anything. Plaintiff's expert said on cross-examination (Vol. I, p. 513) "I do not recall any place in the State patent which refers to radial stretching".

When plaintiff's counsel recited the characteristics of the licensees' machines in the deposition of Seiberling he did not attribute any stretching of the skirts to the centrifugal force (Vol. I, p. 398), and we do not think that plaintiff's counsel has ever taken this position in any brief filed either in the Sixth or in the Third Circuit.

Plaintiff's own expert testified in regard to the State patent (Vol. I, p. 484):

> "the sides of the fabric are formed by radial stretching *due to the action of the spinning-rolls.*" (Italics ours.)

Indeed, the position taken by plaintiff's counsel is that State's method differed from the hand spinning because the latter had, as he alleges, no radial stretch and was not, therefore, of the double stretch class.* Counsel said, in italics, on page 34 of his brief below, that one of State's "principal feats was the introduction [into the hand spinning method] of sufficient radial stretch to convert it into the double stretch system." But on this point the proofs were so overwhelmingly against plaintiff (including his own *ex parte* tests and exhibits therefrom), that the Court below has overruled this contention. Judge Buffington agrees in his opinion (Vol. II, p. 404)

> "that tires embodying these two features of double stretch and roll-spinning fastening were, before the patent to State here in question, hand made."

This emphasizes the fact that the Court below has based its decision upon a distinction not raised even by plaintiff's counsel.

Such being the state of the proofs, it is beyond question that **the majority of the Third**

* *i. e.*, having both circumferential and radial stretch.

Court of Appeals have rested their opinion upon a supposed distinction which has no foundation whatsoever.

When the decision was handed down, a motion for Rehearing was made for the purpose of enabling the Court to correct this error, which so permeated its opinion. In the Petition for Rehearing it was pointed out that the distinction had no foundation in the record and was opposed to the decision in the Sixth Circuit, and was also opposed to the elementary laws of physics. To emphasize this to the utmost the Petition for Rehearing was also accompanied by affidavits of mechanical engineering Professors from three universities (the University of Pennsylvania, Columbia University and Stevens Institute) quoting the statements of Judge Buffington's decision, asserting their incorrectness and pointing out that they were totally opposed to the laws of physics, according to which *centrifugal force cannot operate to radially stretch the skirts.* These affidavits are printed in this record, Vol. II, pages 423 to 428. Perhaps they are not evidence, but they are presented here, as they were presented to the Court below, to emphasize the fact that, in the absence of any evidence to support the supposed distinction, it was a fatal error for the Court to base its opinion upon such an assumption.

The motion for Rehearing was accompanied by one to remand the case for taking the testimony of these Professors upon this point.

The Court below denied both motions without making any change in its opinion and without making any explanation or any attempt to support the erroneous statements therein in any manner whatsoever.

It therefore conclusively appears that the finding

of fact, in which the Third Circuit differed from the Sixth Circuit, and upon which the opinion of the Third Circuit laid overwhelming stress, was wrong both when viewed from the record of this case and from the record of the Sixth Circuit case. It is most respectfully submitted, therefore, that this Court should affirm the decision of the Sixth Circuit, which was correct in its facts and not the decision of the Third Circuit, which was wrong in a fact upon which it was manifestly founded.

We return to this subject later on at page 99, and set forth the showing in this record as to the speeds at which the core is rotated in the hand method, and also in the various machines supposed to be built under or in infringement of the State patent, and the similarity in effect so far as the position of the fabric skirts is concerned.

In opposition to our Petition for Rehearing and Motion to Remand, Plaintiff filed a brief in the Court below which is in this record (Vol. II, p. 429), taking the position that it did not make any difference

> "whether or not radial stretch is effected entirely by centrifugal force, or *entirely by the advancing spinning roll*, or partly by centrifugal force and partly by the spinning roll, or in what proportions by centrifugal force and by the spinning roll." (Italics ours.)

But, if the statements of Judge Buffington above quoted are not facts, it results in re-establishing the fact found by the Sixth Court of Appeals that there was no novelty whatever in the State mode of operation as compared with the hand method, because Judge Buffington's distinction depends entirely upon the erroneous supposition that, in the State mode of operation, it is the *centrifugal force*

that does the radial stretching while in the hand operation this is done by the *spinning roll*. Therefore, the distinction *must* be material because, upon it, decision below in favor of Plaintiff has been grounded.

Overestimate of State's Importance.

Judge Buffington does not find that State was the first to produce a machine-made tire. What he finds is that State was the first to produce a machine-made tire of the *double stretch character; i. e.,* in which the fabric is stretched in two directions while shaping it to the core. He says:

> "This problem State met, and for the first time successfully solved in a machine-made tire of the double stretch character indicated."

His opinion throughout shows the assumption that a double stretch was of the utmost importance and, therefore, that the State patent is to be correspondingly considered. But the evidence is to the contrary.

The Goodrich tires are not double stretch, since the circumferential stretch is 18 per cent. (Vol. I, p. 190), and plaintiff's counsel himself says that this means the single stretch method (Brief below, p. 18).

The Hood tires are not double stretch (Vol. I, p. 204).

The tires made on the defendant's machine are not double stretch. The defendant's machine is not intended to double stretch the tire and when normally operated does not do so (Vol. I, pp. 278, 273).

The only evidence in the case in favor of the double stretch is the interested evidence of State

and the plaintiff Seiberling, himself, who states (Vol. I, pp. 397, 398):

> "Q. 84. Why was it the Goodyear Company has preferred the combined circumferential and radial stretch method to the single circumferential stretch method in the manufacture of tires?
>
> "A. Because the fabric when applied is under less tension, and it makes a stronger carcass.
>
> "Q. 85. State whether or not you have succeeded in getting a more uniform stretch by the combined stretch method than by the single circumferential stretch method.
>
> "A. Well, more uniform as to the sheet of fabric."

This at most is only the expression of an opinion from the one Goodyear Company. No one was called from any of the users of the machines to state that any of them regarded the double stretch as of importance. Seiberling admitted on cross-examination that the machines differed (Vol. I, p. 403, x-Q. 122) and on redirect-examination in stating their characteristics (Vol. I, p. 412, Rd-Q. 201) said nothing about double stretch; the characteristics named by him including only those *disclaimed as lacking novelty.*

The interested expression of opinion by Seiberling is much more than offset by the disinterested expressions of opinion by others in favor of the single stretch over the double stretch. Duncan, president of the Hood Company (Vol. I, p. 203, x-Q. 58), Raymond, vice-president of the Goodrich Company (Vol. I, p. 190). He says that 18% (single stretch) is "considered good practice to-day."

It is a misnomer to call any tire a machine-made tire. They are all made by hand with more or less aid from machinery. The hand is used in making



Extent of fabric spinning in State machine. The remainder is done *by hand*. Note wrinkles or puckers formed in the operation, contrary to Judge Buffington's statement.

tires according to the State patent for attaching the strip to the core in stretching it, as well as for the movement of the spinning roll carriage, and for spinning the fabric on the inner side portions. The only real difference from the hand method is that the machine core is turned by power, as distinguished from hand, while the screw-driven slide is interposed between the hand and the spinning rolls.

Judge Buffington praises the patent as substituting "automatic machine control for human skill" (Vol. II, p. 409). In fact, the machine does *not* do this. The radial feed of the spinning roll is accomplished by hand and subject to the vagaries of human operation, as is admitted by Plaintiff's expert (Vol. I, p. 76). The springs which impart the lateral pressure to the spinning rolls cannot possibly exert uniform pressure, as is also admitted (Vol. I, p. 63). In actual practice, at the Goodyear plant, this pressure is practically entirely manual (Vol. I, p. 232). See also illustrations on pages 189 and 191 of Volume II. In the use of these machines, even at the Goodyear plant, a large amount of the fabric is spun down by hand after the tire has been removed from the machine (Vol. I, p. 233). Looking at the photograph on page 191 of Volume II*, it is seen that the spinning rolls have only laid down about two-thirds of the fabric, yet it is admitted that this is about the limit of their work (Vol. I, p. 626). Instead, therefore, of automatic machine control being substituted for hand work, the fact is that the radial movement of the spinning rolls is performed and controlled almost entirely by hand; and the laying of a large part of the fabric on the core is done by hand. The machines speed up the work—that is all.

Extent of fabric spinning in State machine. The remainder is done *by hand*. Note wrinkles or puckers formed in the operation, contrary to Judge Buffington's statement.

* Reproduced opposite.

The goal of an automatic machine-made tire was much more nearly attained by the Vincent machine and the Belgian machine of the prior art than by the machine of the State patent (Vol. I, p. 249), and the machine of the defendant in this case is also automatic in this regard (Vol. I, p. 276).

It is certainly no invention to supply power instead of hand for turning the core wheel as required. Moreover, Vincent, Moore and the Belgian, as well as Seiberling and Stevens, had already done that, and it had sometimes been done in hand making (Vol. I, p. 148, 186). Beyond that, the only approach to a machine which the State patent added to the hand method was the provision of slides instead of the hand for supporting spinning rolls, and certainly this was not startling. Moreover, before State, a slide had already been provided for carrying the spinning rolls in the Belgian patent and radially swinging arms had been shown in the Moore machine, and in Seiberling & Stevens.

That commercial introduction of a machine is often a very deceptive criterion has been held by this Court in *McClain* v. *Ortmayer*, 141 U. S. 419; *Olin* v. *Timken*, 155 U. S. 141; *Duer* v. *Corbin*, 149 U. S. 216; *Adams* v. *Bellaire*, 141 U. S. 539. In *McClain* v. *Ortmayer, supra*, this Court said (per Mr. Justice Brown):

> "That the extent to which a patented device has gone into use is an unsafe criterion, even of its actual utility, is evident from the fact that the general introduction of manufactured articles is as often effected by extensive and judicious advertising, activity in putting the goods upon the market, and large commissions to dealers as by the intrinsic merit of the articles themselves."

And in *Duer* v. *Corbin, supra,* this Court said:

> "But there are so many other considerations than that of novelty entering into a question of this kind that the popularity of the article becomes an unsafe criterion."

There is, in the present case, not a shred of evidence to negative the inference that other factors, such as the great wealth and influential position of the Goodyear Company, may have largely, if not wholly, contributed to the extensive use of this machine. All we find is that the Plaintiff leased a large number of the machines, *embodying another patent and other claims of the State patent,* and obtained therefor a royalty equal only to a fraction of 1 per cent. on the value of the tires sold. Tire companies, chiefly interested in the manufacture of tires as distinguished from the manufacture of machinery for making tires, might well have considered it advisable to hire these machines and thereby not only obtain a supply of machinery but, at the same time, buy immunity from suit; and this without any consideration of the question of validity of the patent.

The Goodyear Company, with Mr. Seiberling at its head, was a very powerful factor at the time that it adopted the State machine and a very powerful example for others to adopt it. Moreover, it is settled that evidence of this character is only of weight when the question of patentability is in doubt. *Duer* v. *Corbin, supra.* In the present case, there can be no doubt on this point because the Disclaimer has conclusively admitted that the claims of the State patent under which these leases and licenses were granted were, in fact, void.

Again, all these leases contained a license under the Seiberling & Stevens patent also, which in-

cluded broad claims covering the machines, and which was involved in the *Firestone* suit and, originally, in this suit. The Court of Appeals for the Second Circuit has held in *Fielding* v. *Crouse*, 154 F. R. 377, that, in such case, the extensive use cannot properly be attributed to a single one of the patents and, particularly, to the later one.

But from the standpoint of commercial adoption of a machine for tire making the State machine was by no means the pioneer. The first State machine was in late 1907 or early 1908 (Vol. I, p. 389). The Vincent machine had been adopted by the great Goodrich Company, and also abroad, at least a year earlier (Vol. I, pp. 187, 388), and it has been developed, entirely independently of anything contributed by State, into the modern machines still in use by the Goodrich Company (Vol. I, p. 189). Although the commercial history of the Belgian machine could not be proved, because of the difficulty of proof abroad, particularly after the War, it does appear in the record that Matherne in 1911 offered the Hood Company of Boston machines of the Belgian patent, as well as machines of another type, and the Hood Company selected those of the other type for general use, merely because they were adapted to wind all of the layers of fabric composing a tire continuously on the core instead of in separated layers, as in the Belgian patent and the State patent (Vol. I, p. 204). It is a reasonable presumption that, since Matherne had reached the point of bringing the machine of his patent to this country in 1911, it had been successfully introduced in Europe much earlier and probably as early as the 1906 date of the Belgian patent which antedated State. Later on the Belgian machine was used at the Firestone plant and proved

a practical machine for making commercial tires (Vol. I, p. 161).

Judge Buffington refers to the fact that the Belgian patent was allowed to lapse for non-payment of taxes. Many reasons may be suggested for the default in the Belgian tax. It may have been a mere oversight. It may have been because there was no tire manufacturing going on within the small limits of Belgium or it may have been because of Matherne's change of residence, since it appears from his Belgian patent that he resided in Belgium in September, 1906, and from his German patent that he resided in Berlin in December, 1906. Moreover, this ceases to be of significance in view of his activity as late as 1911 in offering the machine in this country, and the indisputable fact that the machine is, in fact, a practical commercial arrangement.

From the foregoing, it is clear that State is not entitled to be treated as one first in the field, and that the Court below erred in so doing. The Disclaimer (discussed in the following pages) is, of itself, a binding admission to this effect (*Dunbar* v. *Myers*, 94 U. S. 187).

The Disclaimer does Not Avoid the Sixth Circuit Decision.

On December 13, 1918, the Sixth Court of Appeals handed down its opinion that:

> "State had nothing broadly new either in his method or in his selected tools" (257 F. R. 83).
>
> * * * * *
>
> "The evidence that this identical spinning operation was performed upon tire casings by hand tools before State's invention is suffi-

> ciently satisfying to meet all the requirements of the situation."
>
> * * * * *
>
> "the tool of the Belgian patent is a spinning roll, and performs a spinning operation; and, if we are right in what we subsequently say regarding the 'centrifugal force' theory, the Belgian tool in its radial progress was bound to stretch and reshape the fabric in substantially the same way that is done by State. Putting all these things together, State cannot be considered as the inventor of the method" (*id.* 83, 84).

About two months later, on February 15, 1919, the Disclaimer was filed (Vol. I, p. 9) stating that plaintiff had reasons to believe that the specification and claims of the State patent were "in part too broad including that of which said State was not the first inventor". This Disclaimer was, in effect, a manifest acquiescence in the above decision, and admitted in the recited terms that the mechanism set forth in the claims, as they stood, was not patentably new (*Dunbar* v. *Myers,* 94 U. S. 187; *Hillborn* v. *Hale,* 69 F. R. 958, 962; *Bracewell* v. *Passaic,* 107 F. R. 467, 469; *Societe* v. *George,* 135 F. R. 102, 103; *Union* v. *U. S.,* 112 U. S. 624, 644).

The Disclaimer is a remedy provided by the statute (Sec. 4917, *infra,* p. 55) only where "a patentee has claimed more than that of which he was the original or first inventor or discoverer".

Alike, because of the language of the Disclaimer above quoted, the language of the statute and the manifest acquiescence in the decision of the Sixth Court of Appeals, we may take the Disclaimer as an admission of the lack of novelty in the mechanism of the claims disclaimed (cases cited, *supra*)

and from this standpoint may consider whether the Disclaimer injected any patentable novelty into the claims.

The first requirement injected into the claims by the Disclaimer is that the sheet fabric strip applied to the ring-core shall be "previously unshaped". The first question, therefore, is whether this injects any patentability into the claims. We submit that it does not for two reasons:

1. Because the sheet fabric strip applied to the ring-core in the old hand process was "previously unshaped" in the same sense.

2. It is misleading to say that the State sheet fabric strip is "previously unshaped" because it is shaped by the concave tread roller 141 and the crown of the core, as shown in Figure 12*a* of the State patent, before the spinning operation begins.

The second requirement injected into the claims by the Disclaimer is that the ring-core be rotatable at "fast speed" by the power drive. This did not lend any patentability to the claims for the following reasons:

1. In the old hand method the speed of the core during the spinning was a "fast speed" (Vol. I, pp. 107, 117, 127, 137, 147, 153, 194, 286, 294); the low speed being that at which the strip was attached to the tread.

2. The core of the Matherne Belgian patent was described as running at a fast speed or "rapid rotation" (Vol. II, p. 221) during the spinning operation.

3. The core of the Moore patent was described as rotating at a "high rate of speed" (Vol. II, p. 281, line 74) during the spinning operation.

4. The core of the Seiberling & Stevens patent also had low and high speeds.

The third requirement injected into the claims by the Disclaimer is that the fabric shall be "centrifugally thrown out" by the speed of the core. In other words, the Disclaimer defines the degree of fastness of the speed as that which will "centrifugally throw out" the fabric upon which the spinning rolls act. The injection of this requirement did not lend any patentability to the claims for the following reasons:

1. The testimony is overwhelming and unrefuted that the speed of the old hand-operated cores was such that the fabric was "centrifugally thrown out" at the time of the spinning operation (Vol. I, pp. 107, 117, 127, 137, 147, 153, 194, 286, 294).

2. The fabric was "centrifugally thrown out" by the "rapid rotation" of the core described in the Mathern Belgian patent (Vol. II, p. 221).

Thus we have shown that nothing injected into the claims by the Disclaimer lends any patentable novelty to them, and, since the filing of the Disclaimer is in itself an admission of the lack of patentability of the claims as they stood before it was filed, it necessarily follows that the same lack of patentability exists after it has been filed. In other words so far as patentable novelty is concerned, the claims after the Disclaimer are just as invalid as they were found to be by the Sixth Court of Appeals before the Disclaimer.

On what theory then did Judge Buffington suppose that the claims were rescued from lack of patentable novelty by the Disclaimer? It was by

erroneously assuming that the Disclaimer injected into the claims a feature which is entirely foreign to the Disclaimer and to the State patent, which has never had any existence in fact, which has no support in the record, and which is contradicted by the affidavits submitted to Judge Buffington on the application for Rehearing and motion to Remand; this erroneous theory being that, *by the action of centrifugal force,* the "loose fabric *stretched itself radially* and thereby formed radial, diamond-shaped interstices, which contracted the normal length of the fabric".

This theory has been fully considered and refuted on pages 35 to 43 of this brief, and, with it eliminated, there is nothing upon which the majority decision below can rest.

The Disclaimer Invalidates the Patent for the Four Following Reasons:

I.

The Disclaimer Usurps the Function of a Reissue.

The question as to whether or not the Disclaimer accomplishes, in effect, that which could only have been accomplished by Reissue, if it could have been accomplished at all, is far from technical. It is of great practical importance because a Reissue speaks only from the date of its grant and there can be no recovery by Plaintiff for any acts of Defendant occurring prior to the grant of the Reissue. *Moffitt* v. *Garr*, 66 U. S. 273; *Eby* v. *King*, 158 U. S. 366. The Reissue Statute itself (R. S. 4916) covers this point for it says that

> "Every patent so reissued, together with the corrected specifications, shall have the same

> effect and operation in law, on the trial of all actions for causes *thereafter arising*, as if the same had been originally filed in such corrected form". (Italics ours.)

The filing of a Disclaimer, on the other hand, has no effect of canceling the original patent or of preventing recovery for acts committed prior to the date of the Disclaimer. R. S. Section 4922 (quoted *infra*) especially provides for this, and R. S. Section 4917 (quoted *infra*) also covers the situation by saying that "no such disclaimer shall affect any action pending at the time of its being filed".

Therefore, by, in effect, reissuing his patent under the guise of a Disclaimer, Plaintiff puts himself in the position of being able to recover for all past acts of Defendant, if they be held to be infringements, even though such acts were perfectly lawful when they were committed because of the confessed invalidity of the patent.

Another important distinction between these two Statutes resides in the fact that the Disclaimer is filable as of course, while the Reissue application is, by Statute, subject to the examination of the Commissioner of Patents. In this respect, the Statute particularly provides that

> "The specifications and claim in every such case shall be subject to revision and restriction in the same manner as the original applications are."

There is, accordingly, a *prima facie* validity to a Reissue grant which is utterly lacking in the case of a Disclaimer. It is, therefore, not only unlawful to utilize the Disclaimer Statute for a purpose covered only by the Reissue Statute; but it is most unfair to take advantage of the Disclaimer Statute

and file, as of course, a document which changes the patent in the effort to collect tribute from lawfully acting third parties, when such document could certainly not be filed if it were subjected to the scrutiny of the Commissioner, as required by the Reissue Statute.

In his dissenting opinion below, Judge Davis said (Vol. II, p. 416):

> "If claims may be changed so that a combination of elements constituting a simple machine may be modified and formed into a new combination and the elements given a prescribed mode of operation by a disclaimer, it is difficult to know what function a reissue performs."*

The sections of the Statute relating to Disclaimers read as follows:

> "Section 4917: Whenever, through inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, a patentee has claimed more than that of which he was the original or first inventor or discoverer, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented; and any such patentee, his heirs or assigns, whether of the whole or any sectional interest therein, may, on payment of the fee required by law, make disclaimer of such parts of the thing patented as he shall not choose to claim or to hold by virtue of the patent or assignment, stating therein the extent of his interest in such patent. Such disclaimer shall

* The decision of the majority of the Court below sustaining the Disclaimer has been criticized, at least by implication, by the Court of Appeals for the Fourth Circuit, which held *invalid* a Disclaimer that it said was not paralleled in any prior case with the possible exception of the decision of the Court of Appeals for the Third Circuit in the case at bar. See *Rosemary* v. *Halifax*, 288 F. R. 683, 686.

be in writing, attested by one or more witnesses, and recorded in the Patent Office; and it shall thereafter be considered as part of the original specification to the extent of the interest possessed by the claimant and by those claiming under him after the record thereof. But no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing it."

"Section 4922. Whenever, through inadvertence, accident, or mistake, and without any wilful default or intent to defraud or mislead the public, a patentee has, in his specification, claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was not the original and first inventor or discoverer, every such patentee, his executors, administrators, and assigns, whether of the whole or any sectional interest in the patent, may maintain a suit at law or in equity, for the infringement of any part thereof, which was *bona fide* his own, if it is a material and substantial part of the thing patented, and definitely distinguishable from the parts claimed without right, notwithstanding the specifications may embrace more than that of which the patentee was the first inventor or discoverer. But in every such case in which a judgment or decree shall be rendered for the plaintiff, no costs shall be recovered unless the proper disclaimer has been entered at the Patent Office before the commencement of the suit. But no patentee shall be entitled to the benefits of this section if he has unreasonably neglected or delayed to enter a disclaimer."

In *Hailes* v. *Albany*, 123 U. S. 582, 587, the Court said:

"We think that counsel is mistaken in supposing that these sections have reference to

different sets of circumstances as grounds for a disclaimer. They both relate to the same condition of things in that regard, namely, to the case in which a patentee, through inadvertence, accident, or mistake, and without any fraudulent intent, has included and claimed more in his patent than he was entitled to, and where the part which is *bona fide* his own is clearly distinguishable from the part claimed without right. In every such case he is authorized by section 4917 to file a disclaimer of the parts to which he is not entitled; and that is the only section which gives him this right. The object of the other section (4922) is to legalize and uphold suits brought on such patents as are mentioned in section 4917, to the extent that the patentees are entitled to claim the inventions therein patented;"

* * * * *

"we think it clear that there is no authority for amending a patent by means of a disclaimer in the manner in which the appellants have attempted to amend their patent in the present case."

The Reissue Statute (R. S. 4916) is designed for a case where an inventor has failed to cover by his patent all that which was his real invention. Under the Reissue Statute, the claims of a patent may be either broadened (*Miller* v. *Brass Co.*, 104 U. S. 350) or narrowed (*Parker* v. *Yale*, 123 U. S. 87), and the specification may also be amended (*id.*).

The vital distinction, therefore, between the Disclaimer Statute and the Reissue Statute, is that a Disclaimer can only be employed for the purpose of deleting a material and substantial part, which is *definitely distinguishable from the remainder;* while a Reissue can be employed for the purpose of reframing the claims so as to re-state the invention

covered thereby in terms appropriate to the real invention of the patentee.

By way of anticipation, it may be here noted, that Plaintiff, in his brief below, says (p. 83):

> "The meaning of the selected claims is clarified and qualified by the disclaimer,"

and Judge Buffington says (Vol. II, p. 413) that the effect of the Disclaimer is to

> "eliminate from the specification and the construction of the claims all elements save those which constituted the true disclosure State gave the art."

We submit that this shows an effort to reissue the patent by way of Disclaimer, which latter cannot be used for the purpose of clarifying indistinct claims or eliminating elements from claims, but only for deleting definitely distinguishable parts of the thing patented, which parts the patentee no longer chooses to hold by virtue of the patent.

II.

The Disclaimer Rewrites the Claims.

The parts of the Disclaimer relating to the claims of the State patent which have been sustained by the Court below read as follows:

> "First. In respect to each of claims 4, 5, 6 and 7 of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the ring-core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-

core by centrifugal force, and the recited spinning-roll support is mechanically mounted to insure its radial movement with a gradual advance in proper relation to the fast rotating ring-core, whereby the spinning-roll, by such gradual advance over the ring-core and while pressed toward it, acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

"Second. In respect to each of claims 12 and 13 of said patent, I hereby disclaim any combination of the recited elements, *except for* the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core and thereafter shaping and applying to the ring-core the fabric beyond the tread portion, *and unless* the recited elements are so constructed and co-ordinated that before the change from slow speed to fast speed the fabric strip as drawn from the recited stock roll onto the ring-core is stretched circumferentially under uniform tension while applying it to the tread portion, and, after the change to fast speed, the unapplied fabric beyond the tread portion is thrown out from the side of the ring-core by the consequent centrifugal force, while the recited spinning-roll, in its radial movement, acts gradually upon the centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core beyond the tread portion while bringing it into adhesive contact therewith.

"Third. In respect to each of claims 22, 23, 24, 25 and 26, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a suffi-

ciently high speed rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll, in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith."

To illustrate the effect of the Disclaimer, we show, in parallel columns, the first claim in suit (4) as written in the patent and as modified by the Disclaimer, the modifications being printed in italics.

As in the Patent.	**As Modified by the Disclaimer.**
4. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core,	4. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, *only when the ring-core is rotatable at fast speed by the power drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force,*
a radially moving support laterally spring-pressed toward the core,	a radially moving support laterally spring-pressed toward the core, *only when the said support is mechanically mounted to insure its radial movement with a gradual advance in proper relation to the fast rotating ring-core,*

and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, *only when the spinning-roll, by such gradual advance over the ring-core and while pressed toward it, acts gradually upon the centrifugally thrown out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith, substantially as described.*

and

only when the combination of the elements recited in the claim is constructed and co-ordinated for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion.

Reference to the recent decision of the Court of Appeals for the Fourth Circuit in *Rosemary* v. *Halifax*, 280 F. R. 683 (cited *supra*, p. 55), which, by implication, at least, disapproves (on p. 686) the decision of the majority of the Court below, will show that the Disclaimer, therein printed on page 685, and which was held invalid by that Court, was no more objectionable than the one at bar.

The mere reading of the Disclaimer must certainly attract attention when it is realized that

the only thing permitted by the Statute is the elimination of "parts of the thing patented" which are "definitely distinguishable from the parts claimed without right"; and when it is remembered that this Court had held in *Hailes* v. *Albany*, 123 U. S. 582, that if the change "requires an amended specification or supplemental description to make an altered claim intelligible or relevant, whilst it may possibly present a case for a surrender and reissue, it is clearly not adapted to a disclaimer".

Plaintiff says that he disclaims any combination of the elements recited in claims 4, 5, 6 and 7 except when they are constructed and co-ordinated for operating upon a previously unshaped sheet-fabric. What is meant by disclaiming "any combination" of the elements is not clear, since there can naturally be in a given claim only one combination of the recited elements. Furthermore, if those elements are shown and described in the patent as being "constructed and co-ordinated" for performing a particular function, then the recitation in the Disclaimer that they are disclaimed unless constructed and co-ordinated for performing said function, amounts to nothing. If the said elements are not shown and described in the patent as thus constructed and co-ordinated, then no Disclaimer can validly impart to them such construction and co-ordination. Hence, these parts of the Disclaimer are either meaningless or illegal.

Turning to the statement that the combinations of the claims are disclaimed except when operating upon "unshaped sheet-fabric", it will be observed that this constitutes an effort to define a claim in a machine patent by the nature of the material upon which it operates.

Not only is a Disclaimer unadapted to such a purpose, but this construction would make the same apparatus infringing or non-infringing according to whether or not the material upon which it operates was flat or partially shaped prior to the operation of the claimed elements. The material operated upon by a machine cannot be a part of the combination claimed. (*Morgan* v. *Albany*, 152 U. S. 425.) In *Motion* v. *Universal*, 243 U. S. 502, this Court fully considered the question of a machine patent with respect to the material upon which the machine operates, and stated:

> "Plainly, this language of the statute and the established rules to which we have referred restrict the patent granted on a machine, such as we have in this case, to the mechanism described in the patent as necessary to produce the described results. It is not concerned with and has nothing to do with the materials with which or on which the machine operates. The grant is of the exclusive right to use the mechanism to produce the result with any appropriate material, and the materials with which the machine is operated are no part of the patented machine or of the combination which produces the patented result."

As the material itself can be no part of the combination—certainly the condition of the material cannot be.

Another feature of this part of the Disclaimer is that the patentee discards any combination of the recited elements except when used to apply the fabric "to that part of the recited ring core beyond the tread portion,". Any part of the combination of elements which has to do with applying and

shaping the fabric to the tread portion is thereby eliminated from the claim. Not only is this apparent, but it is admitted by Plaintiff who said in his brief before the Court below (p. 3), that these claims relate "only to a single combination, entirely without reference to either preceding or subsequent operations". But every one of these claims includes a "sheet-fabric supply" as a positive element of the combination. Thus claim 4 says:

> "An open tire shoe making machine comprising, the combination of a sheet-fabric supply, etc."

and this fact is emphasized because this element was inserted in these claims by amendment after the same had been rejected by the Patent Office (Vol. II, pp. 335, 337), and State said to the Patent Office at the time this amendment was made (Vol. II, p. 355) that he had

> "put as an element into each claim a sheet fabric supply, either generically, as in claims 4 to 10, or else specifically, as in the claims mentioning the stock roller for carrying sheeted fabric."

So that the plain and avowed effect of this portion of the Disclaimer is to eliminate from the elements recited in combination in these claims one of the recited elements. If it were law that a Disclaimer could be used for the purpose of excising an element from a combination claim, one of the fundamental principles of patent law would be wrecked, because thereby a member of the public who had relied upon the claim as written and made a machine which did not infringe because it omitted one of the elements recited in the claim, could lose his entire investment and become an infringer through the

simple expedient of the patentee filing a Disclaimer eliminating from the claim the element which was absent from the machine of said member of the public, and thereby obtaining an injunction and accounting against this perfectly innocent person who had relied upon the most firmly established canon of the patent law that one who omits an element of a claim does not infringe it. (*Cimiotti* v. *American*, 198 U. S. 399.) If this Disclaimer is good, what becomes of all the decisions of this Court that a patentee is bound by his claims as framed, and that, as against him, every element recited must be considered to be material? (*Minerals* v. *Butte*, 250 U. S. 336.) How can a patentee be said to be effectively bound if he can, at any time, cancel an element from his claim by the simple act of filing a Disclaimer? Nothing more iniquitous and of graver portent could be conceived than to permit this latitude to a patentee. Indeed, no such effect could even be obtained by reissue. *Shepard* v. *Carrigan*, 116 U. S. 592, 598; *Huber* v. *Nelson Manufacturing Co.*, 148 U. S. 270; *Yale* v. *Berkshire*, 135 U. S. 342; *Leggett* v. *Avery*, 101 U. S. 256.

In the present case, this change would make these claims cover the activities of a person who applied the fabric circumferentially to the tread of the core by hand, providing he thereafter used the remaining elements of the claims as recited in the Disclaimer; and yet, this person would not be employing "a sheet-fabric supply", which is not only shown and described in the patent but which was required to be put into these claims as a positive element of the combination before the Patent Office would allow the same.

It is also fundamental that the elimination of

an element from a claim broadens the claim, and yet Judge Buffington says:

> "In this case, there is no element of fraud, bad faith or an attempt to broaden the disclosure or claims, but an honest effort to eliminate from the specification and the construction of the claims all elements save those which constitute the true disclosure State gave the art."

With respect, it must be submitted that this statement is self-contradictory, since the learned Judge agrees that the Disclaimer eliminates elements in construing the claims, and such elimination necessarily broadens the claims. Furthermore, the true disclosure which State gave the art is the disclosure of the specification and drawings of the patent, and they expressly show, describe and emphasize the supplying of the fabric to the core from a source of sheet fabric supply.

In another aspect, this portion of the Disclaimer is equally vicious, because, by eliminating the sheet fabric supply as an element of the claims, it has made new combinations, which certainly cannot validly be done by Disclaimer. That the Disclaimer has this effect is admitted by Plaintiff, since he says in his brief below (referring to claim 22 as an example) that the Disclaimer "makes it a new combination" (p. 185). When the combination is changed, the invention covered by the claims is changed, and the cases are unanimous that this cannot be done by Disclaimer. *Hailes* v. *Albany*, 123 U. S. 582; *Strause* v. *William*, 235 F. R. 126, 130 (C. C. A., 2); *Albany* v. *Worthington*, 79 F. R. 966 (C. C. A., 2). As Judge Davis said in his dissenting opinion (Vol. II, p. 416):

> "If claims may be changed so that a combination of elements constituting a simple ma-

chine may be modified and formed into a new combination and the elements given a prescribed mode of operation by a disclaimer, it is difficult to know what function a reissue performs."

The Disclaimer also says that any combination of the claims is discarded "unless the ring core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force,". The claim itself says nothing about any "fast" speed of the core, but the specification mentions this in several places and illustrates the speed as 207 R. P. M. (p. 2, line 8). This is the only fast speed mentioned in the patent so that, if this part of the Disclaimer is to find any basis in the specification and to be at all definite, it must refer to a speed of substantially 207 R. P. M. But here another difficulty develops, because it would not be possible to draw the fabric onto the core from the sheet fabric supply if any such high speed core were used. At such speed the core would make a complete revolution in less than one-third of a second and, as it is necessary for the workman, when drawing the fabric on to the core from the sheet fabric supply, to stop the core at the end of each complete revolution and sever the wound-on fabric from the supply, it is obvious that any such speed would be out of the question in connection with this operation. The patent says that the speed employed when drawing the fabric onto the core is only 6 R. P. M. (p. 2, line 3). This throws further light on Plaintiff's anxiety to eliminate the sheet fabric supply as an element from these claims, because the fast speed which the Disclaimer attributes to the core could

not be used in connection with a sheet fabric supply.

The other significant point of this part of the Disclaimer is the statement that the fast speed shall throw the unapplied fabric portion out from the side of the ring core by centrifugal force. The Disclaimer does not say to what extent or angle the fabric is thrown out, so that this language is entirely indefinite.

Plaintiff's expert says (Vol. I. pp. 66-70), "I do not understand that any particular angle is meant,"; that centrifugal force would be used to the best advantage if the fabric were thrown out smoothly at right angles to the core, and that this occurs (for a medium size core) at a speed somewhat between 80 and 120 R. P. M. He does not know at just what speed this does occur (Vol. I, p. 68, x-Qs. 95-97), and cannot state within 45 degrees at what angle the fabric must be thrown out in order to do useful work (Vol. I. p. 69, x-Qs. 100-102).

There is no support in the patent specification for bringing in this feature of centrifugal force as an element of the invention. It is only mentioned once and there as an obstacle to be overcome. The patent says (p. 6, line 36):

> "The fact is when the ring-core is rotating at high-speed, the centrifugal force tends to throw the fabric out at a right angle from the core-plane and unless the roller recedes in the manner shown, the fabric will become entangled with it."

The Court of Appeals for the Sixth Circuit said, 257 F. R. at page 87:

> "Centrifugal force is not mentioned in State's specification, save as creating an obstacle to be avoided."

Finally, the Disclaimer says that the combination of elements in the claim is disclaimed unless the spinning roll "acts gradually upon the centrifugally thrown out fabric to shape it to the side" of the core. There is nothing in these claims as they stand to say that the spinning roll shall act upon centrifugally thrown out fabric, so that this is another instance of changing the claim by the Disclaimer.

That the above mentioned parts of the Disclaimer do amount to a rewriting and changing of the invention covered by these claims seems to have been admitted by the Plaintiff, since he said on pages 184 and 185 of his brief below, when referring, as an example, to claim 22 (and the argument equally applies to claim 4):

> "In the claim as it originally stood, there was no reference to the speed, and this is now supplied."
>
> * * * * *
>
> "In the claim as it originally stood, while the spinning-roll is said 'to shape the sheeted fabric on the core', there was no reference to its action upon the 'centrifugally thrown out fabric'. This is now supplied."

These elements of high speed and centrifugally thrown out fabric are supplied by the Disclaimer to all the claims sustained by the lower Court, so that the admissions in Plaintiff's brief below apply to all. It is such "amending a patent by means of a disclaimer" which this Court has disapproved. *Hailes* v. *Albany*, 123 U. S. 582, 587. A Disclaimer cannot be used to "supply" things to a patent or claim thereof. It can only be used to delete a part which is "clearly distinguishable" from the remainder.

In *Hailes* v. *Albany, supra*, the patent was on a stove in which the fire-pot had slots in its side in order to promote better combustion by feeding air from the bottom to the coals in the fire-pot. In the patent drawings the fire-pot was shown as having the slots extending from the bottom substantially half-way up the sides thereof, but the specification simply said the fire-pot was

> "made with vertical openings through its sides for the admission of air into the body of coal within it."

The claim of the patent in suit read as follows:

> "arranging a perforated fire-pot with a grate bottom within a circular stove having provision for the admission of air below the point of suspension of said fire-pot, substantially as described."

A Disclaimer was filed by the patentee which read, in part, as follows:

> "Your petitioners, therefore, hereby enter their disclaimer to so much of the first claim as covers perforations or openings in the sides of a suspended fire-pot extending throughout the entire depth of sides, and limiting such perforations or openings to substantially the lower half of the fire-pot, the material or substantial part of the thing patented in and by said claim not hereby disclaimed being as follows:
>
> "A fire-pot suspended from its upper edge with substantially the upper half of its sides made solid, and substantially the lower half of its sides containing perforations or openings."

In spite of the fact that, as above noted, the structure claimed by the language of the Disclaimer was clearly shown in the drawings of the patent, this Court held the Disclaimer and patent to be void and

used the following language (per Mr. Justice Bradley):

> "And if it requires an amended specification or supplemental description to make an altered claim intelligible or relevant, whilst it may possibly present a case for surrender and reissue, it is clearly not adapted to a disclaimer. A man cannot, by merely filing a paper drawn up by his solicitor, make to himself a new patent, or one for a different invention from that which he has described in his specification. That is what has been attempted in this case.
>
> * * * * *
>
> "It is contended that the drawings annexed to the patent may be referred to for the purpose of defining the invention and showing what it really was. But the drawings cannot be used, even on an application for a reissue, much less on a disclaimer, to change the patent and make it embrace a different invention from that described in the specification.
>
> * * * * *
>
> "we think it clear that there is no authority for amending a patent by means of a disclaimer in the manner in which the appellants have attempted to amend their patent in the present case."

To the same effect are *Enameled* v. *Western,* 269 F. R. 620, 628, 629 (C. C. A., 6); *Strause* v. *William,* 235 F. R. 126, 130 (C. C. A., 2); *Fisher* v. *Automobile,* 201 F. R. 543, 545, aff. 209 F. R. 225 (C. C. A., 2); *Albany* v. *Worthington,* 79 F. R. 966, 969 (C. C. A., 2); *Westinghouse* v. *New York,* 139 F. R. 265, 267.

None of the cases cited by Plaintiff constitutes an authority for sustaining the present Disclaimer, since none of them had to deal with any such document. *Silsby* v. *Foote,* 14 How. 218, is the leading case, so that, if it does not support Plaintiff, none of the other cases do. In that case, what the pat-

entee did was to disclaim the application of the metallic rod

> "to any other use or purpose than that of regulating the heat of a stove,"

He limited the invention to a particular class of objects, *i. e.*, stoves. Such a Disclaimer amounts to a definite limitation of the patent to the specific purpose set forth in the patent so as to obviate too broad a construction. For instance, if, in the present case, State had said in his patent that the machine could be used not only for making tires but also for making life preservers; he probably could, by Disclaimer, limit the claims to a machine for making tires alone, thereby excluding any breadth of scope which might cover machines for manufacturing life preservers. But there is not a thing in these instances which parallels the present circumstances; and there is not any authority whatever for using a Disclaimer to eliminate from a claim one element of a therein recited combination, or for "supplying" to the claim other features to which it previously "made no reference". If such a practice were law, there would be no limit to the extent to which patents could be amended and changed by Disclaimer, and the whole theory of the patent law that the disclosure of a patent must be definite so that it can be relied upon by the public (*McClain* v. *Ortmayer*, 141 U. S. 419, 422) as well as the basis for the long line of cases which sustain intervening rights against broadening of claims even by reissue (*Miller* v. *Brass*, 104 U. S. 350; *Corbin* v. *Eagle*, 150 U. S. 38) would become of no avail. Plaintiff seeks, by the Disclaimer, to rewrite these admittedly invalid claims so as to make unlawful acts of Defendant which were lawful at the time they were committed.

While we have, in this brief, adopted the

method attributed to the patent by Plaintiff's expert, for the purpose of comparing it with the prior hand and machine methods, it is necessary, in considering this aspect of the Disclaimer, to point out that the method or mode of operation actually described in the patent is quite different in that, instead of employing circumferential stretch to shape the fabric to the tread portion, it employs a special "tread roller" for this purpose, which tread roller and its function have been eliminated from the patent by the Disclaimer because Defendant's machine has nothing which can even be argued to be a counterpart thereof.

The SECOND section of the Disclaimer is also bad for the reasons above mentioned, except that it apparently does not seek to eliminate the sheet fabric supply (called in these claims "a stock roll for carrying a strip of sheet fabric") as an element of the combination. However, this section of the Disclaimer is faulty in other respects. **It says that the patentee disclaims any combination of the elements except for "the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core" etc. This stretching of the tread portion of the fabric onto the core is not only unsupported by the specification and drawings of the patent —it is positively contradictory thereto.**

There is no need of analysing the THIRD section of the Disclaimer, because it is subject to the same objections. If the First section is bad, obviously the Third section is also bad.

The mode of operation *actually* described in the patent is as follows: Rubberized fabric is led from

a stock roll 25 (Fig. 2) and the end stuck to the top of the core 115. The core is then rotated very slowly, *e. g.*, 6 R. P. M., until the fabric has passed once completely around it. The workman severs the applied fabric from the remainder so as to leave a single layer circumferentially applied to the periphery of the core (Pat. p. 6, line 115). The relationship of the fabric and core at this first stage is diagrammatically illustrated by the patentee in Fig. 12, it being seen that the fabric is caused to adhere only to the extreme outer portion of the core.



Fig. 12.

The patent says (p. 2, line 43):

> "Figs. 12, 12*a*, 12*b*, 12*c* are cross-sections of a ring-core for inextensible-edge tires with the fabric in different stages of application";

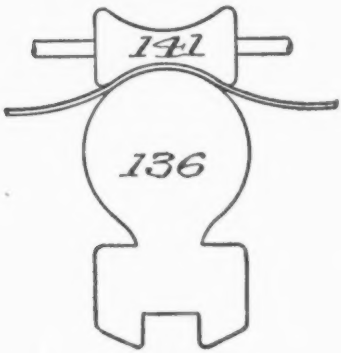
and on page 6, line 67, after referring to the same figures:

> "The fabric in the several stages of application is also shown in these several figures."

Following this, the core is rotated at a very much higher speed (207 R. P. M.), and a so-called "tread-forming-roll" 141 is brought into engagement with the periphery of the core, as indicated in Fig. 12*a**

* Plaintiff ignores the showing of Figs. 12 and 12*a*, because they disprove the mode of operation which he endeavors to read into the patent.

Fig. 12a.



This roll is mounted on the same device as the spinning rolls 147 and is moved inwardly into contact with the core by the manual operation of the same hand wheel; the arrangement being such that the device which supports these different tools is horizontally revolvable so as to bring them, one at a time, into proper position for engagement with the core. This tread forming roll 141 serves to shape the fabric to most of the tread portion of the core, as indicated in Fig. 12*a*.* See the patent, page 6, line 120, where it says:

> "The fast speed mechanism is now brought into play. The tread-forming-roll 141 is then brought into action to shape and smooth the tread-portion of the fabric against the outer periphery of the ring-core."

* Plaintiff also ignores this function of the tread roller, and for the same reason. For other places where the patent says the tread roller shapes the fabric to the tread, see page 5, line 41; page 5, lines 54-60; page 5, lines 85-88; page 6, line 129; page 7, line 1; page 7, lines 114, 115; page 7, lines 125, 126.

The tread roller 141 is now drawn back and moved aside from the core while the spinning rolls or stitchers 147 are brought into position to engage the fabric. These stitchers at first bear on the edges of the fabric which has been shaped to the core by the tread forming roll (the patent says, p. 7, line 6):

> "At first the spinning-rolls are positioned to act upon the edges of the tread portion of the tire-shoe."

They are then gradually moved radially inward in contact with the fabric to shape the latter on the sides of the core, as indicated in Figs. 12*b* and 12*c*.

Fig. 12b.

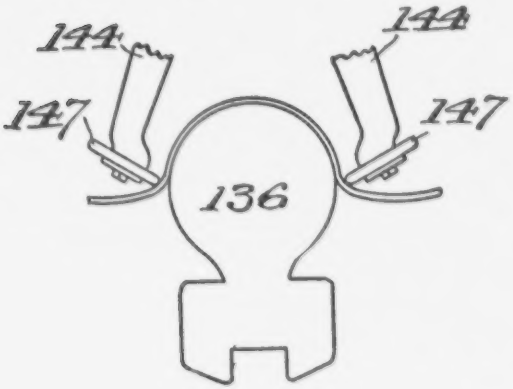
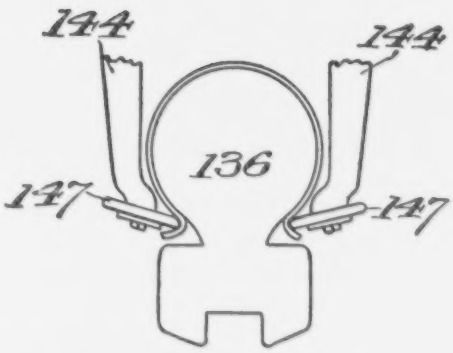


Fig. 12c.



There is not a word in the patent about any stretching of the fabric onto the tread portion of the core as it is applied to the outer periphery.* It is merely stated that the fabric is drawn from the stock roll under tension, and Fig. 12 of the drawings shows that this tension is only sufficient to cause the fabric to adhere to the periphery of the core. After it has been thus applied, the shaping of the fabric to the tread portion is done by the tread roll 141 throughout the central portion and by the spinning rolls 147 at the sides or edges of the tread portion.

The apparent reason for this language of the Disclaimer, to wit:

> "stretching the middle or tread portion of a previously unshaped fabric strip on to the ring-core."

* It should be noted that reference in the State patent to a "stretching roll", refers only to the roll 41, which is spirally grooved, as indicated in Fig. 13 of the patent drawings, so as to laterally smooth out any creases in the fabric as it is being drawn on to the core (p. 3, lines 6-18). There is no device described in the patent as stretching the fabric either circumferentially or radially.

is the fact that Defendant's machine has no tread forming roll but does have mechanism which effectively stretches the fabric in a circumferential direction as it is applied to the core, so as to cause it to closely conform to a large portion of the outer surface thereof. In other words, the patent in suit expressly provides for shaping the fabric to the tread portion of the core by the use of a concave roller 141, while Defendant's machine accomplishes this shaping by simple stretching of the fabric. *Now, by Disclaimer, Plaintiff seeks to change these claims of his patent to make them embody Defendant's mode of operation in this respect.*

Claims 12 and 13, which are affected by this section of the Disclaimer, do not even indicate a tension as being exerted on the fabric. They simply refer to the core as "receiving" fabric from the stock roll. Furthermore, this part of the Disclaimer provides that the shaping of the fabric to the tread portion must be done before the change from slow speed to high speed rotation of the core, while the patent distinctly says that it is done after high speed rotation has begun (Pat. p. 6, line 120).

That the Plaintiff has sought to revise his patent in this respect by the Disclaimer is also shown by that part which cancels the matter on lines 79 and 80 of page 1 of the specification. The sentence of the specification which includes this disclaimed part reads as follows:

> "So, too, the combination of the tread-forming-roll for operating upon the tread portion and the spring-pressed spinning rolls for shaping the sides of the tire shoe by radial motion with reference to the ring-core forms an effective instrumentality for completely shaping the tire *and an important feature of my invention.*"

The part of the sentence which is cancelled by the FIFTH section of the Disclaimer is italicized in the above quotation. The Plaintiff has disclaimed this as being a part of the invention and, through his expert, Browne, asserts that what he now claims for completely shaping the tire is the combination of circumferential stretching of the fabric to cause it to be shaped to the tread portion and the subsequent action of the spinning rolls to cause it to be shaped to the sides. He does not delete a "definitely distinguishable" part—**he changes the statement of the invention.**

It is settled (p. 71, *supra*) that no such change can be made by Disclaimer. The language of this Court in *Hailes* v. *Albany*, 123 U. S. 582, 587, sufficiently covers this situation:

> "A man cannot, by merely filing a paper drawn up by his solicitor, make to himself a new patent, or one for a different invention from that which he has described in his specification."

III.

The Disclaimer has Changed the Patent from a Machine Patent to a Method Patent.

As previously stated, Plaintiff places great reliance upon the method or process which he says is performed by the machine of the State patent. He calls it a "mode of operation". But it really is a method or process, as is well substantiated by the fact that Judge Buffington in his opinion continually refers to it as a "process".

That a process and an apparatus are different inventions cannot be disputed. The Statute itself (Sec. 4886 Rev. Stat.) divides inventions into "new and useful art, machine, manufacture, or composition of matter" and the word "art" is always understood as meaning "process" (*Expanded* v. *Bradford*, 214 U. S. 366). If the process is not distinct from the machine, then it is nothing more than the function of the machine, and cannot be patented (*Busch* v. *Jones*, 184 U. S. 598, 607). The distinction between a machine and a process was succinctly stated by Mr. Justice Bradley in *Tilghman* v. *Proctor*, 102 U. S. 707 (quoted with approval in *Expanded* v. *Bradford, supra*). He said:

> "A machine is a thing. A process is an act or mode of acting. The one is visible to the eye—an object of perpetual observation. The other is a conception of the mind, seen only by its effects when being executed or performed."

This question was again considered by this Court in *Leeds* v. *Victor*, 213 U. S. 301, where it was said:

> "A process and an apparatus by which it is performed are distinct things."

This difference is well illustrated by the two claims involved in that case. The process claim read as follows:

> "The method of reproducing sounds from a record of the same, which consists of vibrating a stylus and propelling the same along the record, substantially as described."

The apparatus claim read:

> "A sound-producing apparatus, consisting of a traveling tablet having a sound-record formed

thereon and a reproducing-stylus shaped for engagement with said record and free to be vibrated and propelled by the same, substantially as described."

By comparing these claims with a typical claim of the State patent in its original condition and as modified by the Disclaimer, it will be apparent that there has, in fact, been a change from machine claim to method or process. Claim 4 as written in the patent, reads as follows:

> "4. An open-tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described."

Here we have a recitation of the mechanical elements; but when we come to the Disclaimer, we find that Plaintiff abandons all combinations of the said elements except when they are applying the said strip to the core "beyond the tread portion", and except when the core is rotatable "at fast speed", and except when the "unapplied fabric is thrown out by centrifugal force", and except when the "spinning roll acts gradually upon the centrifugally thrown out fabric". In other words, the Disclaimer calls for a *method* of shaping a previously unshaped sheet-fabric strip to a portion of the ring core beyond the thread portion, which consists in placing the fabric on the core, rotating the core at fast speed whereby centrifugal force throws the fabric outwardly, gradually acting upon the centrifugally thrown out fabric by a radially moving spinning roll, and bringing the fabric into adhesive contact with the core; whereas the claim as written in the

patent merely calls for the mechanical elements themselves in combination, and says nothing about a previously unshaped fabric strip, rotating the core at fast speed, centrifugal force, or acting upon thrown out fabric.

In the *Leeds* v. *Victor* case, the method claim calls for *propelling* the stylus along the record, just as the Disclaimer calls for a spinning roll *acting* gradually upon centrifugally *thrown out* fabric while *bringing* it into adhesive contact with the core. In both instances the claims call for the *doing* of something or, as said in *Expanded* v. *Bradford*, they call for "an act, or a mode of acting", and the said decision says that such an act or mode of acting is a "process". Again, in the cited decision, it is explained that the apparatus is "an object of perpetual observation" while the process is seen only by its effects "when being executed or performed". Surely, the fast speed rotation of the core, throwing out of the fabric by centrifugal force, the gradual action of the spinning roll upon the centrifugally thrown out fabric and the bringing of it into adhesive contact with the core can only be seen while these steps are "being executed or performed"; so that, necessarily, this language of the Disclaimer reads what this Court has expressly defined as a process into this claim of the patent in suit and, as the Disclaimer abandons the combination of mechanical elements recited in the claim except and unless they operate according to the terms just quoted, the said claim, which was nothing but a plain apparatus combination, has been changed by the Disclaimer to a method or process. For instance, a party might have a replica of the mechanical elements shown, described and claimed in the patent and yet, if he operated the machine slowly enough so that the

rotation of the core would not generate such centrifugal force as to throw out the unattached fabric, or if he employed a guard to prevent the fabric from being thus thrown out even though the core were rotated rapidly enough to generate adequate centrifugal force, he would not comply with the Disclaimer and would not infringe. Therefore, the Disclaimer, in a nutshell, says that the combination claimed in the patent is disclaimed except when it is being operated in a certain way or when it has, as this Court said, in the *Expanded* v. *Bradford* case, a particular "mode of acting". This amounts plainly to disclaiming the claim as an apparatus claim and asserting a monopoly under it as a process claim, since he now actually *claims* the "mode of acting" or, as Plaintiff calls it, the "mode of operation".

This argument applies equally to claims 4, 5, 6, 7, 22, 23, 24, 25 and 26; and even more strongly to the remaining two claims (12 and 13) for, with respect to them, the patentee has disclaimed all combinations of the recited mechanical elements "except for the combined operations of first, *stretching* the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core and, thereafter, *shaping* and *applying* to the ring-core the fabric beyond the tread portion", and he further disclaims the mechanical combination unless the fabric is circumferentially stretched "under uniform tension while *applying* it to the tread portion", unless the "unapplied fabric * * * is thrown out * * * by the consequent centrifugal force", and unless the spinning roll "acts gradually upon the centrifugally thrown out fabric * * * while bringing it into adhesive contact with the core."

The two claims which constituted the subject matter of the decision of this Court in the case of *Leeds* v. *Victor, supra,* are particularly useful in determining this fact that the Disclaimer changes the claims of the State patent (at least in part) to method or process claims, because this proposition formed the substance of the opinion and decision in the said case, where it was held that they constituted distinct and separate inventions.

In the light of this comparison, how can it be said that Judge Davis was wrong in his dissenting opinion to the effect that the Disclaimer had, at least in part, changed the claims to a method?

There are numerous other facts which point to this same conclusion. For instance, it has been admitted by Plaintiff, in his brief below, that, in order to obtain the centrifugal force called for by the claims as modified by the Disclaimer, it is necessary to rotate the core at a speed somewhere between 80 and 120 R. P. M. He said (brief below, p. 35):

> "This centrifugal force is not manifest at all at a speed of less than 80 R. P. M. and it does not become effective until 'somewhere between 80 R. P. M. and 120 R. P. M.'."

and on page 37, it is said that a speed of 80 to 120 R. P. M. is "the minimum requirement". On page 49 of the same brief, Plaintiff became even more specific where, referring to a speed of 95 R. P. M., it was said to be "almost to the required high speed of core rotation". Surely, the rotating of a core at a speed above 80 R. P. M. and thereby generating centrifugal force is a step in a process. To maintain the contrary is utterly to disregard the fundamental distinctions laid down by this Court in *Expanded* v. *Bradford* and *Leeds* v. *Victor, supra.*

A very recent decision along this line is *in re Peters,* 289 F. R. 637, in which the Court of Appeals of the District of Columbia was considering an invention relating to a stirring apparatus for slaking lime. It was attempted to sustain the claim because of a clause stating that certain arms operated beneath the surface of the material being treated, and the Court of Appeals said:

> "The attempted limitation in the structural claims of the arms beneath the surface of the material treated belongs to process rather than structure. The amount of material in the container has nothing to do with the structural characteristics."

A claim for a machine cannot lawfully, by Disclaimer, be changed to a claim for a method or process. This is obviously true under the doctrine that machines and processes are different inventions. *Leeds* v. *Victor, supra,* and *Hailes* v. *Albany, supra.*

No such change is even authorized by Reissue. As said in *Heald* v. *Rice,* 104 U. S. 737, 753:

> "The case comes directly within the principle held in *James* v. *Campbell* (p. 341 *ante*) that a patent for a machine cannot be reissued for the purpose of claiming the process of operating that class of machines; because if the claim for the process is anything more than for the use of the particular machine patented, it is for a different invention."

To the same effect is *Grant* v. *Walter,* 148 U. S. 547.

IV.

The Disclaimer Unqualifiedly Cancels Claims that Include the Whole Substance of the Claims Sustained by the Court Below.

Paragraph Fourth of the Disclaimer unqualifiedly cancels claims 8, 9, 10, 11, 14, 15 and 17. Examination of claim 8 shows that it is directed to the same structure as claim 4 (sustained below) in almost identical language, except that 8 also includes "a radially movable tread-forming-roll for shaping the outer portion of the tire", so that in cancelling claim 8, Plaintiff cancels a claim that includes every element of claim 4, and which is narrower than claim 4 because it is limited by the additional element "tread-forming-roll". But the reason for filing the Disclaimer, as formally recited therein, is that the patent is in part "too broad". If claim 8 is too broad and has, therefore, been unqualifiedly disclaimed (which Plaintiff cannot deny), how can claim 4 be validly maintained. While individual claims have frequently been cancelled from patents by Disclaimer, we never before have seen a case in which the Disclaimer cancels the narrow claims and retains the broad ones. As claim 4 is well illustrative of the whole group of claims 4, 5, 6, 7, 22, 23, 24, 25 and 26, this argument, in substance, applies to all.

The same situation and same argument apply to claims 12 and 13 when considered with respect to claim 14 which has been unqualifiedly disclaimed, since the latter includes the whole substance of claims 12 and 13 with the addition of certain limiting details.

Plaintiff has, in fact, under pretence of cancelling claims which are too broad, cancelled narrow and worthless claims, while retaining the broader claims. Realizing that this could not be done openly, he has attached a myriad of words of interpretation to each of the broad claims retained, which interpretation serves in part to broaden the said claims by eliminating elements and in part to write new elements thereinto, in the effort to form a basis for reading the claims clear of the prior art, and, at the same time, making them cover Defendant. Plaintiff knew that such a procedure could not find success through the medium of a Reissue, because the latter is, by Statute, subject to the scrutiny of the Patent Office. He therefore chose a Disclaimer, which is filable in the Patent Office as of course. Surely, the Court below should not have countenanced this procedure, and should not have given weight to the alleged invention described in the Disclaimer, any more than did the Court of Appeals of the Sixth Circuit when the same alleged invention was urged as a matter of mere construction of the patent.

The Method or Mode of Operation Read into the State Patent by the Disclaimer was Old.

The plan of claiming novelty for State on the basis of his alleged method or process or mode of operation is not a new one with Plaintiff since, in the *Firestone* case, he realized the weakness of the State patent as a machine patent and endeavored to have the Sixth Circuit Court of Appeals construe

it as a method patent. That Court said (257 F. R. 82):

> "Plaintiff really presents his case on the theory that State discovered a new method of making tire casings or a new set of functions to be performed by associated mechanism."

and went on to say that the prior hand making of tires anticipated this method of State (257 F. R., p. 83):

> "The evidence that this identical spinning operation was performed upon tire casings by hand tools before State's invention is sufficiently satisfying to meet all the requirements of the situation."

In the *Firestone* case, Plaintiff did not deny that the hand spinning operation was the same as the method of State's patent. Indeed, he impliedly stated that it was the same by asserting that it was an "imitation" of the method of the State patent. His contention in that case was that this method was subsequent in point of time, and therefore, did not anticipate State. In his brief before the Sixth Circuit Court of Appeals, Plaintiff said:

> "Our second contention is that this procedure in hand operation was a mere feat suggested by and in imitation of the State invention."

The Sixth Circuit Court of Appeals ruled against Plaintiff on this point, and much additional testimony in support of this ruling was presented by Defendant in the present case, so that there is an overwhelming body of evidence which establishes the general use of this hand spinning method by the best known tire factories years prior to State's

alleged date of invention (Fall of 1907 or Spring of 1908). To meet this Plaintiff has now changed his ground to an argument that the hand process, though prior in time, was not the same as the process of the State patent.

The trial Court in the present case found as a fact:

> "The method or process used is the same which the proofs showed that for many years prior to the patent had been used in the making of tires by hand" (Vol. II, p. 399).

Duncan, president of the Hood Tire Company, showed that this method had been followed at his factory since the Spring of 1906 (Vol. I, p. 191 *et seq.*). This hand method has already been described in this brief on pages 2 to 7, so that we shall merely refer to the testimony here. This method continued in the Hood plant from 1906 to 1911 and 1912, and even after that it continued on the large size tires until the Summer of 1918, when the War Industry Board took the factory (Vol. I, p. 203, x-Q. 61).

The use of a similar method was described by Roe (Vol. I, p. 166), Consulting Engineer of the Republic Rubber Company. He is another man of standing, having been Assistant Engineer and Chief Engineer for the Diamond Rubber Company and its successor, the B. F. Goodrich Company. He described this process at the Diamond Plant in April, 1907, at the McGraw Tire Company as late as 1915 to 1917, and at the Republic Rubber Company as late as 1917 to 1919.

Mell (Vol. I, p. 152), Technical Advisor to the Superintendent of the Firestone Tire & Rubber Company, described this process at the Republic Company as early as 1906. There he was Manager

of the Tire Department and Experimental Engineer.

Stark (Vol. I, p. 125), General Foreman of the Tire Department of the Miller Rubber Company, described this method as followed by him and others at the Diamond Rubber Company beginning as early as 1903. He showed that this method was also followed at the Miller plant after he came there.

Walch (Vol. I, p. 285), Foreman of the Tire Department of the Ajax Rubber Company, told of this same hand spinning process at the Ajax Company as early as the year 1906. He said that he personally followed this process for five years beginning in 1906 and saw others doing the same.

Testimony to the same effect, was given by Green (Vol. I, p. 135), Curtis (Vol. I, p. 293), Koplin (Vol. I, p. 92), Drach (p. 99), Derry (p. 107), Heller (p. 115), Gregg (p. 146) and Bittaker (p. 173). Gregg employed a power-driven-core in this operation at the Diamond plant as early as 1907 (p. 148). He is corroborated in this by Bittaker (p. 176).

All testified that the fabric was stretched circumferentially on the core, that the core was then rotated fast enough so that the fabric spread out from the sides and that the operation of spinning down the fabric thus standing out was successfully accomplished in commercial practice for the production of the regular output of tires.

Plaintiff's counsel was zealous to have the witnesses admit that there was also another method of making tires by hand, which he called the "saw-tooth" method, although the importance of this is not clear, since if it were a fact that there were a half dozen other methods of making by hand,

it would not negative the force of the fact of the hand spinning practice as an anticipation of the method which plaintiff has sought to read into his State patent.

As already indicated, the Court of Appeals for the Sixth Circuit found that this prior hand spinning was "identical" with the method attributed by Plaintiff to the State patent. The decision of the majority of the Court below, holds that the method of the State patent differs from the hand method because the core was rotated faster by the machine than by hand and thereby generated centrifugal force which automatically stretched the fabric edges radially so that they would smoothly fit the sides of the core. See quotations, *supra*, p. 37. This is the sole point of difference which the Court below finds between the hand process and machine process, and is the point upon which it bases its disagreement with the Court of Appeals for the Sixth Circuit, the District Court of New Jersey, and the dissenting member of its own bench.

In presenting his argument to the Court below, Plaintiff contended that this hand process was not the same as the process of the patent in suit on the ground that the tires made by the hand process did not have any radial stretching of the side portions of the fabric. Plaintiff maintained that the hand-made tires had circumferential stretch and that tires made on the State machine had both circumferential and radial stretch of the fabric. He therefore called the hand operation a "single stretch" method, and the machine operation a "double stretch" method. It is unnecessary to discuss this point at any length with reference to the evidence discrediting it, including plaintiff's exhibits of tires

made by hand-spinning; or to emphasize the fact that the patent in suit does not mention anything about radial stretch or double stretch, because the Court below has disagreed with this position of plaintiff and explicitly held that the hand process involved the double stretch. It is said in the opinion below (Vol. II, p. 404):

> "we note the fact that tires embodying these two features of double stretch and roll-spinning fastening were, before the patent to State here in question, hand made."

Nor does the Court below deny that, in the hand-spinning method, the loose edges of the fabric, referred to as "the flying skirt", were thrown out from the core by the centrifugal force inevitably generated in the rapid rotation by hand. The evidence on this point is overwhelmingly in favor of defendant. Duncan, President of the Hood Tire Company, testified as follows (Vol. I, p. 195):

> "Q. 12. While the core with the fabric on it was rotated, as you have described, what position did the edges of the fabric take or maintain?"
>
> "A. The fabric stood out at approximately right angles to the plane of the core."

Heller testified (Vol. I, p. 117):

> "Q. 21. When the core was spinning fast, what position did the edges of the fabric take?"
>
> "A. Straight out."

Testimony to the same effect is given by nine other witnesses (Vol. I, pp. 93, 100, 107, 137, 148, 154, 177, 286, 294). There is no evidence to contradict this showing.

From the foregoing, it is seen that there is no conflict between the two Courts of Appeals as to the fact that the hand-spinning method did produce both circumferential and radial stretch. It is also seen that the Court below does not dispute the abundant evidence to the effect that the rotation of the core by hand caused the skirts of the fabric to fly out. This necessarily results because of the centrifugal force generated by the rapid rotation (Vol. I, p. 154). Nobody disputes the fact that, in the hand-spinning method, the spinning roll or stitcher was moved radially in contact with the fabric so as to shape and smooth the outflying skirts to the sides of the core.

Therefore, we come right back to the one point upon which the Court below has based its decision, viz., that, in the method of the State patent, the core was rotated so fast that it generated centrifugal force of such strength that the fabric skirt *stretched itself radially* and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric (*supra*, p. 37).

While agreeing that the same radial stretching was accomplished by hand and by machine, the Court below says that the machine did it by centrifugal force and the hand operation did it by the spinning roll; and upon this distinction, decision in favor of Plaintiff has been grounded. But how can it legitimately be maintained that the spinning roll did this work in the one case and not in the other? In his understanding of the machine process, Judge Buffington attributes to the spinning rolls merely the function of plastering or cementing to the sides of the core the outflying skirt of the fabric which has been radially stretched by the centrifugal force resulting from the high-speed rotation

of the core. Thus, he says in his opinion, referring to State (Vol. II, p. 408):

> "Thereby he then, and by the wheels [spinning rolls] pressed and cemented the radially stretched and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge."

And again he says that the spinning rolls were caused:

> "to automatically press the automatically stretched and loose fabric, or skirts, in an unwrinkled state, on the bead of the lower surface of the core."

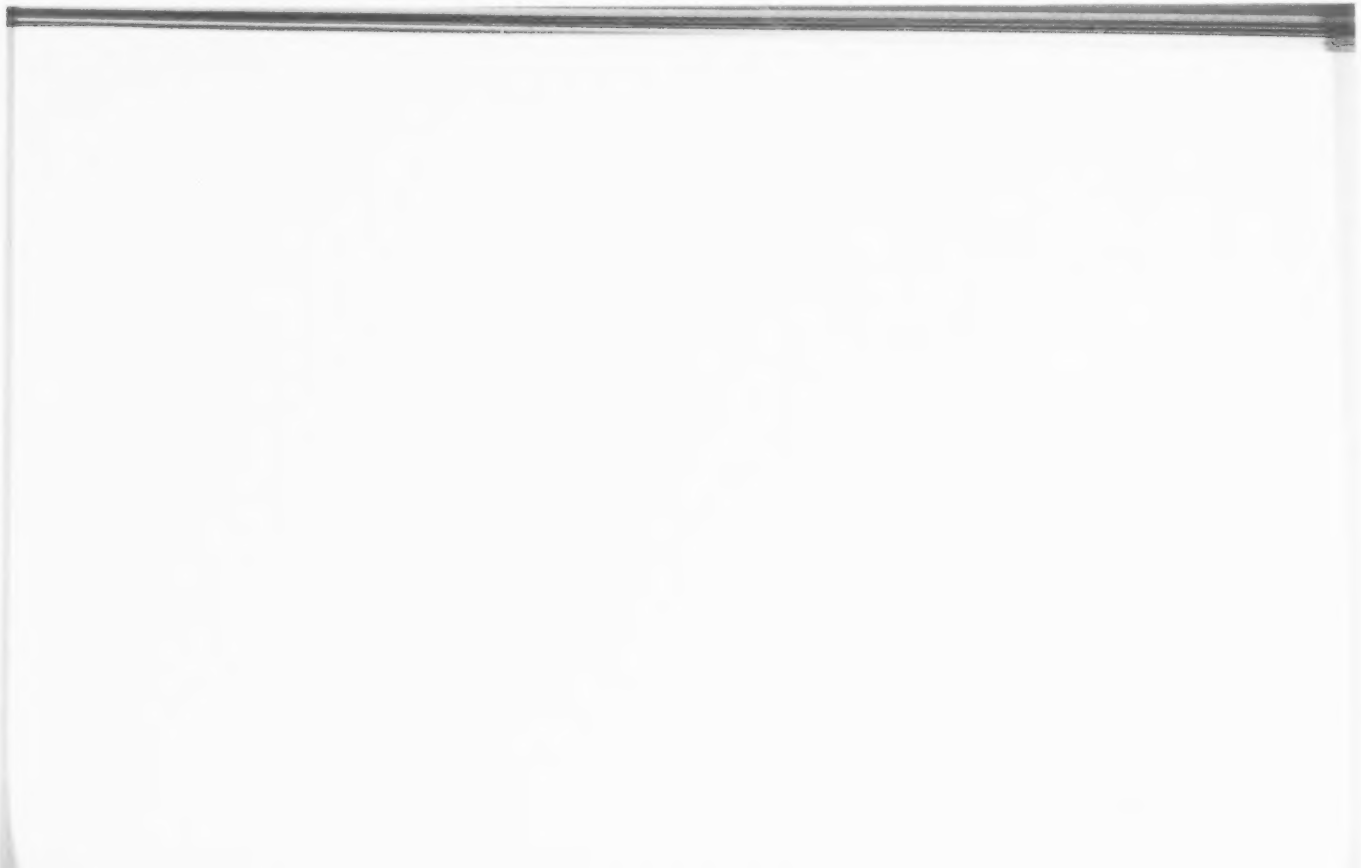
And on page 411, he says that the rolls

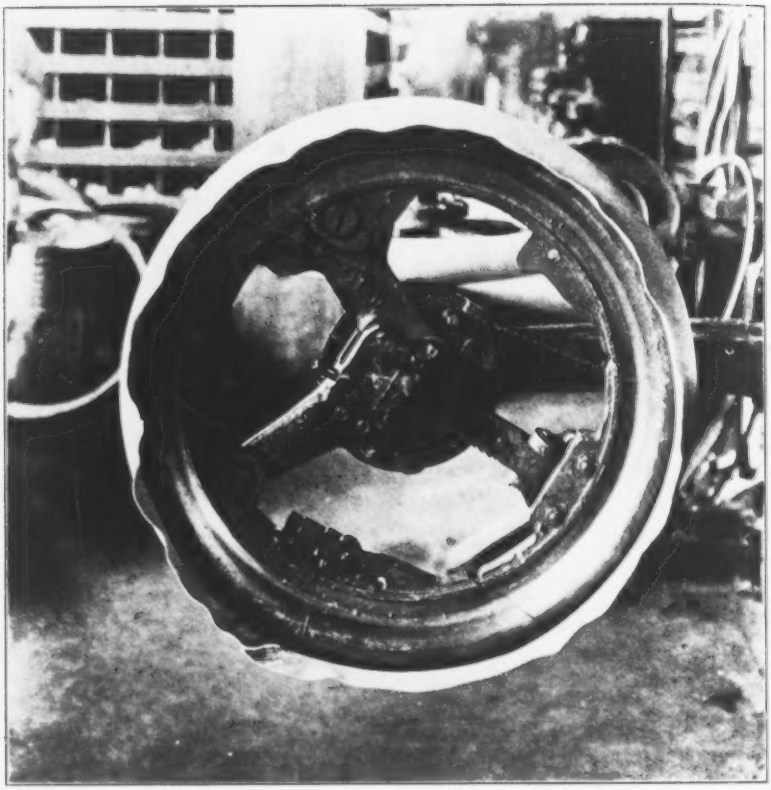
> "plaster an unpuckered, radially distended diamond shaped fabric upon the core."

And again he refers to

> "the utilization of centrifugal force to stretch the fabric and the action of the spinning rolls upon a centrifugally automatically stretched fabric,".

Perhaps it would be sufficient to point out that not even Plaintiff has contended that centrifugal force stretches the fabric. He has only argued that centrifugal force causes the fabric to stand out from the core and that the inward radial movement of the spinning rolls produces the radial stretch against the action of centrifugal force; and has, in the present case, distinguished the hand-spinning method from the machine method on the contention that the spinning roll in the hand method did not produce any radial stretch. As already noted, his own exhibit tires (*e. g.*, Tire





M-9) are conclusive against him on this point, not to speak of much other evidence in the Record, and the Court below has found against him, so that we do not need to argumentatively contest this matter.

But to treat the subject thus briefly would not be fair to the learned Judge who wrote the majority opinion of the Court below and who has based his decision upon an erroneous conception of the processes. This erroneous conception may well have arisen from the fact that Plaintiff has cleverly harped so much upon the expression "centrifugal force" as to render likely confusion of thought on this point, although, at all times, plaintiff has been careful never to contend that the centrifugal force itself produced the radial stretch.

There is, in fact, not a word in the Record to support this holding of the Court below. No one testifies that centrifugal force, *per se*, could produce any radial stretch and, although reference to centrifugal force is repeatedly and confusingly made in the testimony of Plaintiff's expert Browne and in Plaintiff's brief below, in neither place is there any statement that centrifugal force produces the radial stretch. This error, if not at once apparent, can be demonstrated by the opposite picture:

This shows a core with the fabric stretched on the tread portion thereof and its free edges standing out from the sides of the core. When the core is rotated rapidly, centrifugal force will be pulling outwardly at all points on the circumference of the edges of the fabric, and it must be plain, therefore, that this outward pull will tend to enlarge the circumference of the edge of the fabric. This is absolutely inevitable—but this is also a

tendency toward *circumferential* stretch of the said fabric edges, instead of *radial* stretch. Therefore, if the centrifugal force were sufficient to stretch the fabric at all, it would enlarge the circumference of the loose fabric edges and make them less adapted to smoothly fit the inner side portions or bead zones of the core. This circumferential stretch would also change the square meshes of the fabric into meshes of diamond shape, but with their axes *circumferentially* disposed instead of radially disposed. No physicist has denied this and no physicist could deny it. If the centrifugal force were to have any effect toward producing radial stretch and consequent circumferential contraction, as stated by Judge Buffington, it would be necessary that its force be exerted inwardly toward the axis of the core which is, of course, impossible.

This situation called for a Petition for Rehearing which was duly filed, together with a Motion to Remand the case for testimony in the District Court, in case the Court of Appeals did not accept Defendant's proposition that the decision was based upon a misapprehension of the action of centrifugal force (Vol. II, p. 417). This Petition and Motion were denied, without opinion (Vol. II, p. 432), and we wish to make reference to the affidavits filed in support of the same, not with the thought that these affidavits constitute evidence in the case, but to show the *prima facies* of the Petition and that the same should have been granted.

In his affidavit, Dean Pegram, of Columbia University Engineering School, after referring to Judge Buffington's opinion and quoting therefrom, and discussing the necessary action of centrifugal

force under the circumstances in question, said (Vol. II, pp. 426, 427):

> "With all respect, I am compelled to state that the effect of centrifugal force in distorting the mesh of the band of fabric would therefore be the opposite of that stated in the opinion.
> "I may say further that it does not appear to me that the centrifugal force at such speeds as are used by the Plaintiff would be great enough to produce any appreciable distortion of the mesh of this rather firm fabric."

Professor Kavanaugh, of the University of Pennsylvania, after referring to Judge Buffington's opinion and his own observation in a tire factory, and explaining just how centrifugal force does act, said (Vol. II, p. 424):

> "I am compelled to state, with the greatest respect, that the numerous references in the opinion of his Honor, Judge Buffington, to the radial stretching effect of centrifugal force, necessarily imply a misinterpretation of the physical force at work, since its action is the opposite of that recited in the opinion."

He also said, by way of illustration (Vol. II, p. 424):

> "Furthermore, the amount of centrifugal force which is generated as a result of rotating a core adapted for making a tire about 35 x 4½ in size at 130 R. P. M. is insignificant and utterly impotent to produce any stretch in the outflying skirts of the fabric. It actually amounts, in a tire of the size stated, to approximately 0.168 ounces for each square inch of fabric in the flying skirt. The circumferential stress or pull developed in the skirt by this centrifugal force is only 2.562 ounces

> per inch of the skirt width. I have made tensile tests of this fabric which show that a stress or pull of this amount stretched or elongated the fabric less than 1/8 of 1 per cent.; which is a negligible amount, and which is, moreover, against radial stretch."

Professor Anderson, of Stevens Institute of Technology, after making similar remarks, said (Vol. II, p. 428):

> "With great respect, I am positive in the assertion that, under the conditions of tire manufacturing described, centrifugal force can have no tendency to cause the fabric to stretch itself radially and thereby form radial diamond-shaped interstices which contract the normal length of the fabric, as stated by his Honor, Judge Buffington."

Now, it cannot be that these three scientific men are wrong and Judge Buffington right.

The Court below recognized that the prior hand process had produced both the circumferential and radial stretch. The evidence was overwhelming and uncontradicted that the rotation of the core in the hand process had caused the fabric to fly out at right angles so as to resist the inward, radial movement of the spinning tool. But Judge Buffington found that in State's machine process, the rotation of the core was so "speeded up" that the centrifugal force generated thereby caused the fabric to "stretch itself" radially, so that all the spinning rolls had to do was to "plaster" this "automatically stretched" fabric onto the core (*ante*, pp. 37 *et seq.*).

In this he was fundamentally wrong, as cannot be denied.

It should be noted that there was no burden on Defendant to disprove this holding of the Court below that centrifugal force produced the radial stretch in the machine process and that all the spinning roll had to do was to plaster or cement the centrifugally radially stretched fabric on the sides of the core. There is not a word in the patent about any such thing, and Plaintiff did not make such contention; so that there was never cause for Defendant to disprove this finding of the Court of Appeals of the Third Circuit.

This brings us right back to the proposition that the hand-spinning method had the rapidly rotating core, the edges or skirts of the fabric outflying under centrifugal force, and the spinning roll moving radially inwardly and producing radial stretch in the fabric to conform it to the core; so that the only thing left is the statement that State "speeded up" the rotation of the core in the process attributed to the patent. It is true that the patent names a very high speed of rotation—207 R. P. M. Defendant does not use anything above 125-130 R. P. M.; and neither does Plaintiff. Hence, this high speed named in the patent cannot be relied upon to sustain Plaintiff's case, and there is left merely the moot point that the rotation of the core by the machine was somewhat faster than its rotation in the hand process. Even this is expressly denied by some of the witnesses who testified with regard to hand spinning. Thus Walch, for thirteen years Foreman of the Tire Manufacturing Department of the Ajax Rubber Company, said (Vol. I, p. 291):

> "x-Q. 53. Do you think the speed of rotation that you gave the core by hand was as great as that now present in the operation of the

> Thropp machine? Do you understand the question?
>
> "A. Well, it is very near the same; there was not much difference; you can twist the core just as fast as the Thropp machine."

Stark, General Foreman at the Miller Rubber Company, testified to the same effect (Vol. I, p. 129):

In view of the fact that the result produced by the hand-spinning method and by the machine was the same (as the Court below agrees), and that there is not any evidence to support a holding that, in the method attributed to the State patent, the radial stretch was produced by centrifugal force and not by the spinning roll, it might be assumed to be true that the machines rotated the core more rapidly than the hand process and still this would amount simply to a difference in degree which, under all the authorities, does not constitute invention.

As said by this Court in *Wright* v. *Yuengling*, 155 U. S. 47, 52:

> "it is a mere difference in degree, a carrying forward of an old idea, a result, perhaps, somewhat more perfect than had theretofore been attained, but not rising to the dignity of invention. We have repeatedly held patents of this description to be invalid."

And in *The Railroad Supply Company* v. *The Elyria Iron and Steel Co.*, 244 U. S. 285, this Court said:

> "the mere carrying forward of the original thought, a change only in form, proportions

or degree, doing the same thing in the same way, by substantially the same means, with better results, is not such an invention as will sustain a patent."

Plaintiff's *Ex Parte* Tests of the Hand Spinning Method Support Defendant's Position.

Plaintiff endeavored to show by test some substantial difference in strength between tires made today by the hand spinning process and tires made today on one of the Goodyear Company's commercial tire making machines. As this test was *ex parte* and conducted by Plaintiff, the results can, of course, be used with full force against him, while they are of very little weight in his favor. *Bemis* v. *Charles*, 177 F. R. 717; *Bethlehem* v. *Niles*, 166 F. R. 880, 888 (aff. 173 F. R. 1019); *Mark* v. *Greenwalt*, 32 App. D. C. 253.

The man selected to make the tires by hand was a building contractor who had not been connected with the manufacture of tires for about ten years (Vol. I, p. 419, x-Qs. 31-41). He had, however, at an early date, made these tires by the hand spinning method at the Diamond Rubber Company, and Plaintiff said in his brief below (p. 67) that these tires "were made by the hand spinning method in the way he formerly made them in the Diamond plant", so that whatever success was obtained in this hostilely conducted test not only weighs heavily against Plaintiff, but must be attributed to the quality of the tires made at the Diamond plant prior to State's invention. Furthermore, it is reasonable to suppose that this witness made the tires

better when he was actually engaged in that work than he did after a layoff of ten years.

It is sufficient, without pointing out the many discrepancies in these tests unfavorable to defendant, to state in concise form certain results which plaintiff cannot dispute.

Examination of these tires made by hand spinning will show that they embody the so-called "double stretch". As noted (*supra*, p. 92) the Court below agrees that the hand spinning process does produce this.

After these tires were made, they were tested by subjecting them to internal hydraulic pressure until they burst, corresponding tests being given the machine made tires. The hand made tires burst at the following pressures in pounds: 395, 393, 393, 392, 391, 396, 391, 408, 364, 358, making an average of 388.1; and the machine made tires burst at 480, 450, 421, 405, 442, 408, 462, 424, 409, 449, 464, 425, making an average of 433.75 (Vol. I, p. 538). One of Plaintiff's experts (Ray) says that the difference between the two sets of tires is 12 per cent. (*id.*, p. 539).

As the ordinary pressure for tires of this size when in use is admitted to be only 75 to 80 pounds (Vol. I, p. 579), this difference in the bursting pressure of the two sets of tires is immaterial and a mere paper difference; since the figures show that the hand made tires would stand an internal pressure of five or six times that to which they would be subjected when in use.

These figures also show that the hand made tires were much more uniform than the machine made, there being a difference of only 50 pounds between the highest and lowest of the hand made tires, while there is a difference of 75 pounds between the highest and lowest of the machine made. Following

out the method of calculation employed by Plaintiff's expert Ray, this means that the hand made tires were 50 per cent more uniform than the machine made. This uniformity in the hand product is quite striking when it is observed that seven out of the ten tires burst at a pressure between 391 and 396 pounds.

Again, the metallic bead rings which are built into these tires for service will only stand a pressure of from 350 to 360 pounds (Vol. I, p. 539, Q. 57). Every one of the hand made tires burst at a pressure equal to or above this, the average approximating 30 pounds above. Hence, the fabric of these hand made tires was stronger than the regular beads that hold the tires onto the vehicle rim, so that, in use, the beads would have given way before the fabric.

Finally, every one of these hand made tires burst in the tread portion (Vol. I, p. 578, x-Q. 202). Not a single one of them burst at any point on the side where the fabric had been formed down by the hand spinning process, so there is nothing in these tests to show that the fabric spun down by hand was any weaker than that spun down by machine.

From the foregoing, we find that these tests made by Plaintiff demonstrate that the hand spinning of tires is practical and satisfactory, that the product is in strength well beyond that required under any conditions of service and, in uniformity, much superior to the tires made by the Goodyear Company's commercial machines which Plaintiff alleges embody the State patent. **By this evidence also Plaintiff's criticisms of the hand spinning method are shown to be unfounded. His assertions that this was a single stretch process, that great skill was required, that the process was not**

applicable to large tires, that the core speed was irregular and too low, that the roll pressure was irregular, that there were other defects, such as the slipping or jumping of the spinning roll, and that the tire quality was poor, are all flatly contradicted and demonstrated to be unsound by his own self-appointed tests. Surely, if a biased operator running the commercial machines of today could only make tires which were 12 per cent stronger than tires produced by the hand spinning process carried out by the one employed by Plaintiff, and who had not made a tire for ten years; and if the said hand made tires were 50 per cent more uniform than the machine made tires, were stronger than the metallic beads embodied in corresponding commercial tires, and would stand a pressure of five or six times that required in use; there can be no legitimate criticism directed at this hand spinning method.

Putting this situation in the best light for Plaintiff, it shows nothing more than a change in degree coming directly within the cases cited on page 100, *ante*. The fact that the machines could doubtless make the tires faster (though Plaintiff does not emphasize this point) does not alter or tend to alter the fact that the hand spinning method is the same as the method followed by the machine and that, therefore, no novelty or patentability can be attributed to the machine because of the method which can be followed in its operation (*Marchand* v. *Emphen*, 132 U. S. 195; *Conroy* v. *Penn*, 155 F. R. 421, 422, 423; affirmed 159 F. R. 943. In this position, we are directly supported by the decision of the Court of Appeals for the Sixth Circuit and the District Court of New Jersey.

The Step Covered by the Claims.

In his opinion, combatting the decision of the Court of Appeals for the Sixth Circuit, Judge Buffington refers to the alleged process of making the tires by the machine of the State patent and emphasizes the position that the issue does not relate to an operation performed on a part of the tire. He says (Vol. II, p. 407):

> "We are not dealing with the making of the tread portion of a tire alone, and with its consequent necessary circumferential stretch and the formation of circumferential diamond shaped interstices in the fabric in such tread portion. We are not dealing with the making of the median zone of the shoe [tire], with the interstices square and unstretched. Nor are we dealing with the making of a bead zone where the stretch is radial and the interstices are radially pointed diamond shaped."

This understanding and emphasis of the learned Judge is submitted for particular consideration in view of the fact that Plaintiff's case is based upon the proposition that the claims, as limited by the Disclaimer, do cover nothing more than a single one of these steps, namely, the radial stretching and formation of the fabric in the bead zone, *i. e.*, "beyond the tread portion". As stated by plaintiff in his brief below (p. 6):

> "The only thing here involved (except in claims 12 and 13) is only one of these sequential operations.
>
> * * * * * *
>
> "There is no longer any claim on the original stretching or tension devices. There is no longer any claim on the tread-forming roller.

> These have dropped out of the case either by intentional omission or as a result of the statutory disclaimer. The only thing here advanced is the combination of the forming or spinning-roll with the high-speed core."

And the Disclaimer itself disclaims any combination of the claims except

> "for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion" [*i. e.*, the bead zone].

Of course, the question here at issue is the subject matter of the claims as they stand, and the decision of the Court must necessarily be based thereupon. How can the Court be justified in waving aside these facts and grounding a decision in favor of the Plaintiff upon things which he has formally disclaimed?

The Claims in Suit are Anticipated by Belgian Patent to Matherne.

(Vol. II, pp. 217-227.)

This patent was granted September 20, 1906. The Court of Appeals in the *Firestone* case made reference to it particularly with respect to its method of operation, because that was the basis upon which Plaintiff staked the validity of the State patent; and the Court, after carefully observing the Belgian machine at work, held that it operated "to stretch and re-shape the fabric in substantially the same way that is done by State" (257 F. R. p. 84).

Plaintiff resists the anticipatory effect of this patent upon the assertion that the described mode

of operation is different from the mode of operation attributed by his expert to the State patent. He reads into the State patent a mode of operation not described therein and contradictory to the description therein; then reads into the Belgian patent a mode of operation different from that described therein; and says that, because of the difference in these assumed modes of operation, the Belgian patent does not anticipate the State patent. **Plaintiff is unable to deny that the Belgian patent shows a machine for making the same kind of tires as the State patent; which machine contains the instrumentalities of the State patent, and can be operated according to the mode of operation which he reads into the State patent.** He is unable to deny that it fully anticipates all the claims in suit, except as they are modified by the Disclaimer.

In the present case, this patent has been pleaded in the regular way and proofs taken with respect thereto. A full size machine is also in evidence. This machine is well shown in the photographs which constitute Defendant's Exhibit D. Waterman describes the construction and operation of the machine of this patent beginning Vol. I, page 241.

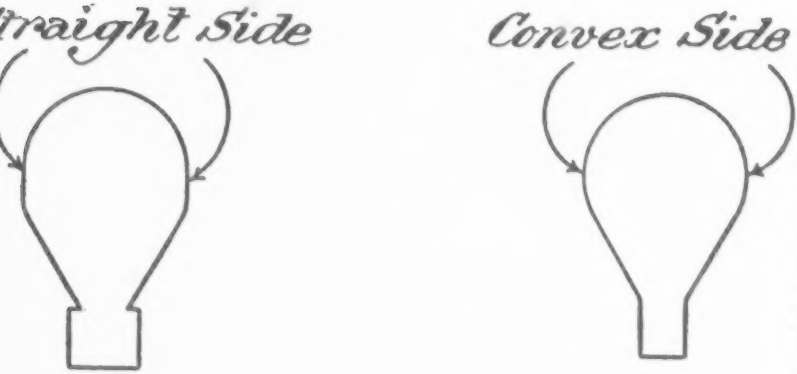
As a matter of convenience, a brief description of the Belgian patent will now be given.

Referring to Fig. 1 of the drawings, the machine includes a core 10, which is of the same kind as that in the State patent and which is likewise mounted for rotation. Power mechanism and gear changing mechanism are provided for rotating this core at low and high speeds. Rubberized canvas strips are drawn from the stock roll 18, at the right, onto the core, passing between oval or

spherical rolls 26 and conical gears 36 located between the stock roll and the core. The convex shape of these rolls is intended to slightly stretch or lengthen the center of the fabric so as to make it fit better to the tread of the core, while the gears are described as forming slight puckers uniformly arranged at the edges, so as to insure that the subsequent contraction of this part of the fabric in shaping it to the core shall be uniform. They also hold the edges of the fabric out laterally and prevent them from sticking to the sides of the core while being drawn thereon.

The stock roll is mounted on a shaft provided with a band brake, shown in Fig. 2 at 21, 22, 23 and 27, which may be adjusted to produce the desired pull on the fabric strips. The core as in the State patent is coated with rubber solution so that the tread portion of the fabric adheres to it and is pulled along by the core in its rotation. This machine does not have State's tread forming roll 141, but, as defendant's machine does not have any such roll, this point is immaterial in this case. The Belgian patent does, however, have a pair of rollers 30 shown in Figs. 2, which act upon the sides of the core adjacent the tread. The patent says that these rollers reciprocate so as to stick the fabric to the *straight* or *convex* sides of the core. These two types of core are well represented by the two patents originally in suit. The State patent shows, in Fig. 9, cores which have a rounded or convex side portion before they taper off in a straight line toward the inner circumference; while the Seiberling and Stevens patent shows in Figs. 5, 6 and 8 a core, the side portions of which are flat before

they taper off toward the inner circumference (Vol. II, pp. 264, 266). See following cuts:



While the Belgian suggests that these rollers be operated on just this portion of the sides of the core, he also states that this operation may be varied according to the desire of the operator, saying "the roller may be placed at any desired point on the core". To this end he mounts the rollers in an adjustable casing 28, which is slidable on the track 34. In operation, the rubber impregnated fabric is led from the stock roll around and between the rolls 26 and gears 36, and the end of the fabric is stuck to the core. The core is then caused to rotate at slow speed and draw the fabric along with it under such "pull" as the operator has predetermined by adjustment of the brake mechanism. During this slow rotation of the core, the canvas encounters the rollers 30 which are rapidly reciprocating on the convex or straight sides of

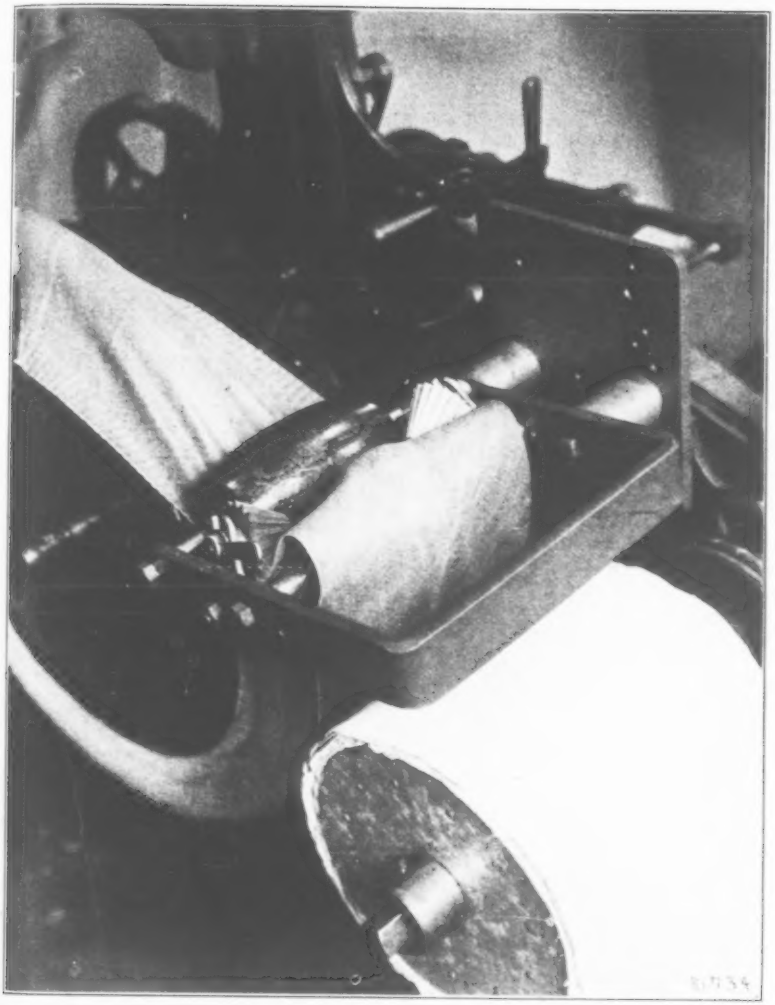
the core as just described, according to which kind of core is being used. The drawing of the fabric onto the core causes it to shape itself to the tread portion of the core, while the action of the rollers 30 is to stick the fabric to the side portion adjacent the tread. The operation of this machine is clearly illustrated by the set of photographs, Defendant's Exhibit D, which have not been criticised by plaintiff.* The condition of the fabric as it is first being drawn onto the core is well shown in photograph No. 6, opposite. Observe how the conical gears hold the fabric edges away from the core.

The condition after a single layer has been completely stretched around the core is illustrated in photograph number 7 and the condition after the rollers 30 have operated on it, in photograph No. 5. In this case the rollers 30 have been adjusted to act pretty far inwardly. Thus these rollers cause the fabric to adhere to the side portions of the core and, at the same time, form puckers or corrugations or wrinkles in the skirts of the fabric. These puckers are initiated in the form of large, loose puckers by the mere stretching on of the fabric, as shown in photograph No. 7, but the action of the rollers 30 in sticking the fabric to the sides of the core, decreases the size and increases the number of the puckers (photograph No. 5). These puckers are also clearly shown in the photograph of the Goodyear commercial machine said by Plaintiff to embody State's patent (Vol. II, p. 191).†

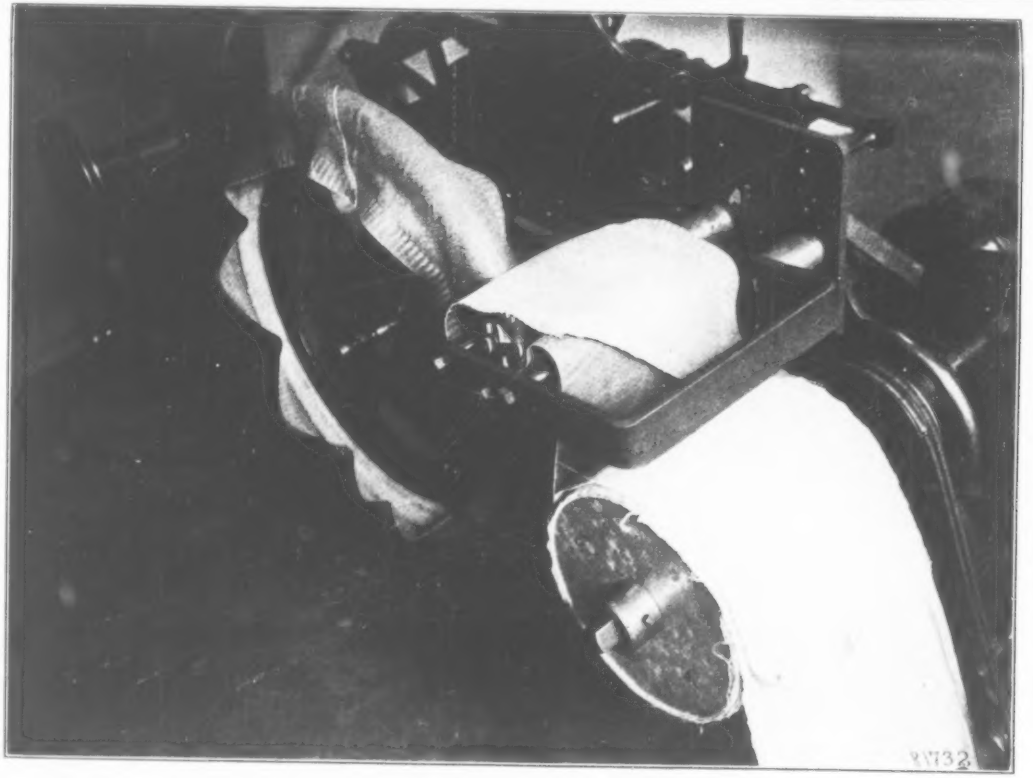
In the next step the carriage on which the rollers 30 are mounted is drawn away, and the drive gearing for the core is changed so as to rotate the latter

* None of the following photographs show the fabric flying out under the influence of centrifugal force because they were necessarily taken while the machine was still.

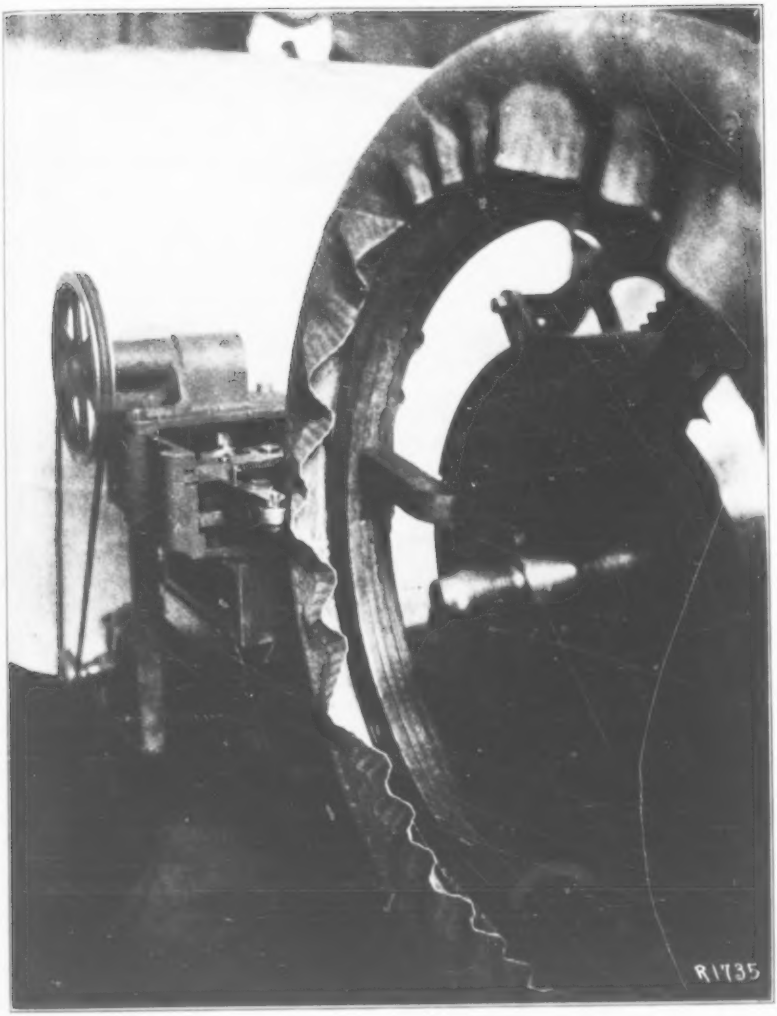
† Reproduced *supra*, page 45.



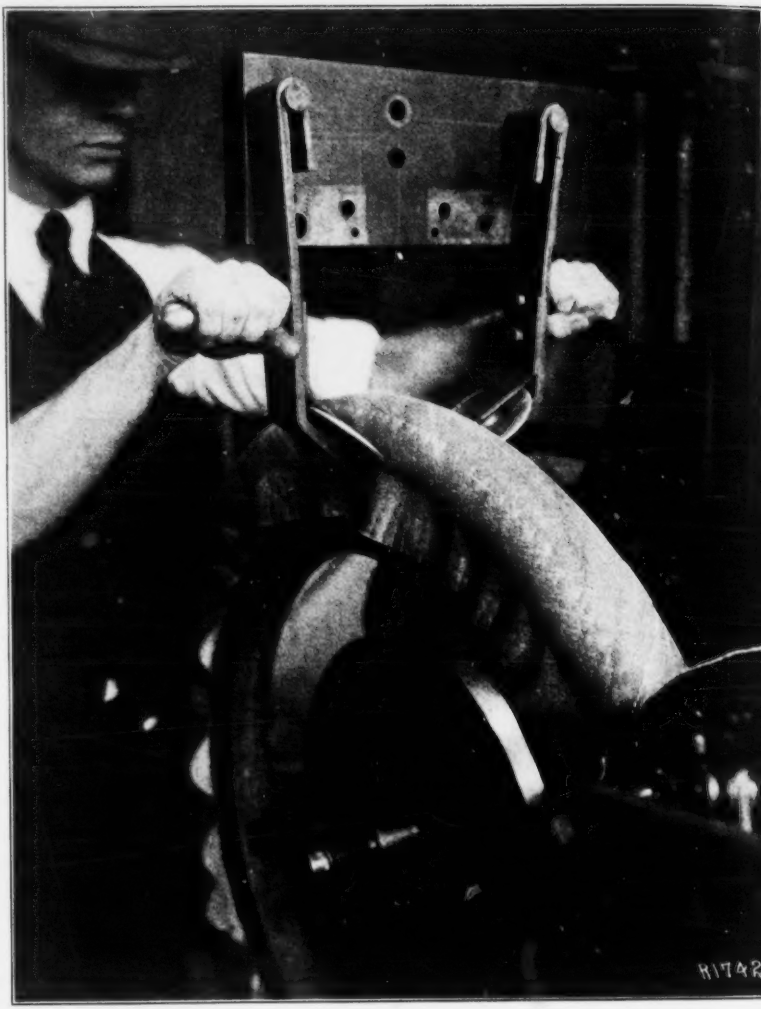
Photograph No. 6



Photograph No. 7



Photograph No. 5



Photograph No. 10

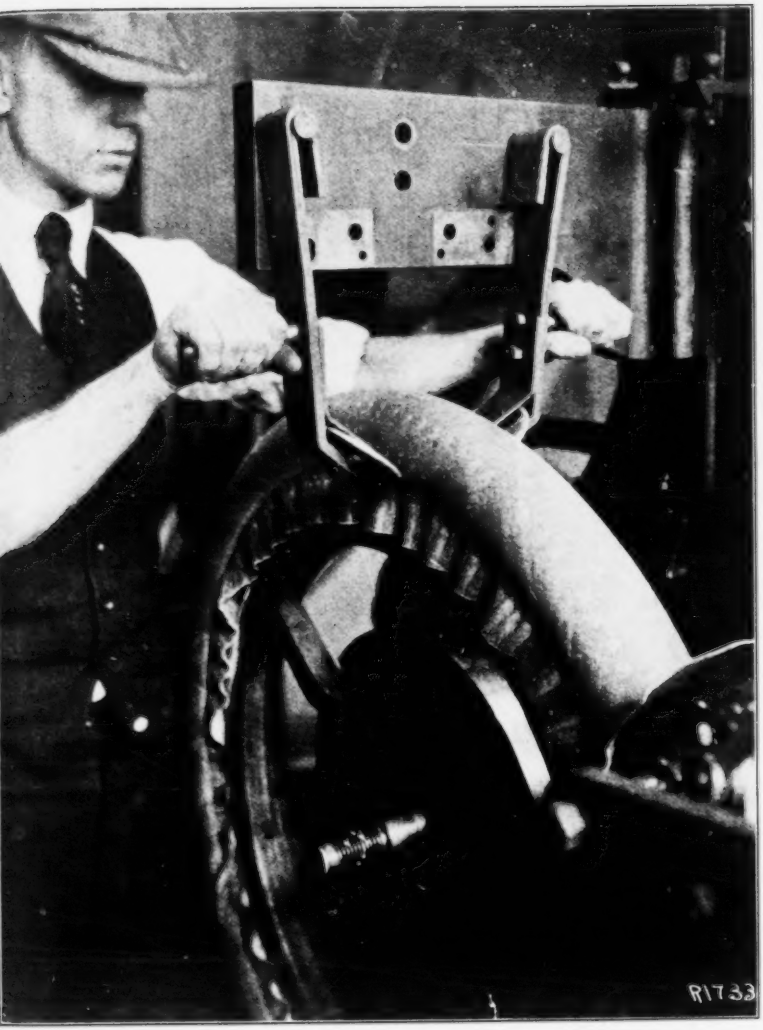
rapidly, as stated in the Belgian specification (Vol. II, p. 221). The ratio of rotation of low speed to high speed is about 1:20. This is about midway between the ratio of the State patent in suit (1:35) and the ratio of the commercial machines and defendant's machine (1:10 or 15), Vol. I, page 55, x-Qs. 34, 35. Both the low and high speed of the Belgian machine can be varied by applying the drive belt to different parts of the pulley 3 (Vol. I, p. 245).

The high speed inevitably throws out the puckered or wrinkled edges or "skirts" of the fabric at an angle to the core. This is an inherent condition in the physics of the thing. It is during this high speed rotation that the Belgian plans to remove these puckers or wrinkles. He, like State, provides for this purpose a pair of spinning rollers such as shown in Fig. 6 of the patent drawing, and in photograph No. 10, of Defendant's Exhibit D, opposite. These rollers have rounded, disk-shaped edges, as called for by the State patent, and they are also carried by arms which are supported on a slide 17 that is fed radially of the core by a screw, plainly shown in Fig. 1, and which has on its upper end a hand wheel. The arms of those spinning rollers are hooked on the pins 15, carried by the slide 17. The screw engaging the slide 17 may be operated by the hand wheel at the top thereof, but the patentee provides a pawl and ratchet mechanism which is designed to automatically feed the slide 17 radially of the core. Thus, while the core is at its high speed rotation, the spinning rolls are fed inwardly radially of the core while pressed laterally against the sides of the core by the hands of the workmen grasping the handles projecting from the arms that support the spinning rolls. This action, at its initial stage, is well shown (Except that the

core is still) in photograph 10 *ante*. A later stage of the same operation is shown in photograph 11, and the final stage is shown in photograph 12.

The photographs referred to correctly show the operation (Vol. I, p. 241, Q. 29, p. 242, line 32). The patent distinctly states that the high speed is "necessary" for the spinning step (Vol. II, p. 218, line 10 from bottom). It seems useless to describe this machine any further, since the above includes all the instrumentalities as well as the mode of operation upon which Plaintiff relies in support of his State patent. We may apply one of the more detailed claims in suit (considered as a claim for apparatus) to this Belgian patent, inserting the corresponding features of the Belgian machine after each element of the claim. Selecting claim 12, the application is as follows:

> 12. An open tire-shoe making machine (obviously the Belgian machine is this) comprising the combination of a stock roll for carrying a strip of sheet-fabric (stock roll 18), a ring core (core 10), a slow speed mechanism for actuating the core when receiving the fabric from the stock roll (sets of gears running from the pulley 3 to shaft 13 and back to core shaft 12), a radially moving spinning roll for passing radially over the side of the tire-shoe to shape the fabric on the core (roll of Fig. 6 and radially moving slide 17 which carries it), fast speed mechanism for actuating the ring-core during the operation of the spinning roll (connection from pulley 3 to shaft 11 and thence through gearing direct to shaft 12) and speed-changing mechanism (lever 14 and connected parts), substantially as described.



Photograph No. 11



Photograph No. 12

It is true that the Belgian patent does not have springs for forcing its spinning rolls laterally against the core, but even Plaintiff has made no point of this as the State patent says it is intended to be broad enough to cover the use of a tool pressed against the core by hand (p. 5, line 116). Furthermore, it is quite customary to use manual power for this purpose even in the modern machines (Vol. I, p. 161, Qs. 21, 22; p. 168, Qs. 16-26; p. 134, Rd-Q. 79). This also is practiced at the Plaintiff's plant (Vol. I, p. 232, p. 622).

Plaintiff seeks to avoid the effect of this Belgian patent by ascribing a different mode of operation to it.

In the first place, Browne says that the action of the rolls 26 and gears 36 partially pre-forms the fabric as it is drawn onto the core (Vol. I, p. 462).

This criticism can be quickly answered. Browne testified on *prima facie* (Vol. I, p. 62, x-Qs. 74, 75);

> "I do not think that any details of the fabric supply of the patent in suit are characteristic beyond furnishing tension upon the fabric as it is drawn onto the slowly rotating core."

and Plaintiff's counsel referred to the fabric supply devices as "extraneous details" (Vol. I, p. 621, Q. 7).

and said on page 6 of his brief below:

> "There is no longer any claim on the original stretching or tension devices."

Secondly, Browne says that the Belgian patent only shows one conical gear 36 on each side of these rolls, and that such an arrangement would not be effective to produce any crimping action on the fabric (Vol. I, p. 475, p. 512, x-Q. 144). His inconsistency on this point is most striking. First he says that the action of these gears is to crimp and

then he says they are arranged so that they cannot crimp. Plaintiff's brief below (p. 153) after discussing the action of these gears, asks "Why does defendant adopt a theory of operation which takes all the utility out of the puckers* when Matherne takes such pains to assign utility to them?" Without admitting the accuracy of the intimation, we might counter by inquiring "Why does Plaintiff adopt a theory of operation of the State patent which takes all the utility out of the tread roll when State has taken such pains to assign an essential operation to it?" In point of fact, Defendant does not exclude these unimportant gears of Matherne, while Plaintiff does exclude State's tread roll which is the only thing shown or described by State for shaping the tread portion.

The next criticism is that the rollers 30 operate throughout the entire sides of the core so as to stick the fabric down onto the core clear to the inner circumference (Vol. I, pp. 463, 464, 471). Browne says that the result of this operation would be to stick the edges of the fabric to the core in a wrinkled condition (Vol. I, p. 464). He apparently describes this as being Matherne's intention. In other words, while he does not deny that the rollers 30 can be operated as Waterman understands, and as shown in the photographs, Defendant's Exhibit D (*e. g.*, No. 5, *supra*, p. 110) he says that Matherne, who was "a well educated, technically trained inventor and designer, with a very thorough knowledge of European tire making practice" (Vol. I, p. 196), nevertheless intended to use these rollers so as to stick wrinkled fabric to the core and ruin the tire. His sole foundation for this is that the patent says these rollers operate on the "sides" of the core, and he says that this must mean the entire sides; together

* Said to be formed by the gears 36.

with the fact that the patent says the operation of the spinning rolls shown in Fig. 6 is to remove puckers or wrinkles which have been previously formed.

This criticism can also be easily answered. In the first place, there is nothing to require that the word "sides" shall means the entire sides. We can refute plaintiff's expert by the claims in suit, which refer to the spinning rolls as passing radially along the "sides" of the tire-shoe, and yet plaintiff maintains throughout, and the Disclaimer says, that these rolls operate only on that portion of the sides beyond the tread portion. Hence plaintiff's expert, through pure caprice, gives opposite meanings to the same word in these two patents.

Secondly, when the Belgian refers to the action of the spinning rollers of Fig. 6, which do spin the fabric all the way down to the inner circumference or base of the tire, he distinctly says so in the following language (Vol. II, p. 220):

> "The roller is caused to descend progressively on the side of the core and all the way down to its base."

If the Belgian meant that the rollers 30 operated to this same extent, why the difference in the descriptive language?

Thirdly, the rollers 30, when properly operated, do stick the fabric to the "straight" or "convex" sides of the core, and do form puckers or wrinkles in the fabric. But these puckers or wrinkles are in the edges of the fabric which are free from the core, as plainly shown in photograph No. 5 of Defendant's Exhibit D, *supra*, page 110; so that the proper and sensible action of the rollers 30 corresponds exactly with the language of the Belgian specification.

Fourthly, Browne's position in this respect is contradicted by the language of plaintiff's own

Seiberling and Stevens patent (Vol. II, p. 258). This patent has means for shaping the fabric to the tread portion and part way down the sides (Pat., p. 2, line 105). It also has reciprocating fingers for forming down most of the skirts of the fabric. As shown by the decision of the Court of Appeals in the *Firestone* case, it was plaintiff's contention that these reciprocating fingers are the substantial equivalent of the spinning rolls of the State patent, and hence, that they act upon fabric which has not previously been applied to the core. This must also have been plaintiff's contention in the present case when he joined this patent in the Bill of Complaint. But this patent says (p. 1, line 52) that these fingers are for "smoothing the wrinkles out along the sides of the shell [tire], while being constructed". And in his brief before the Court of Appeals in the *Firestone* case (p. 20) Plaintiff's Counsel, referring to the Seiberling & Stevens patent, said:

> "These fingers, as in hand operation, serve to stretch the fabric radially, to smooth out the wrinkles, and to lay the fabric conformably along the core."

This is the language which the Belgian employs in describing the function of the spinning rolls of Fig. 6, as plaintiff maintains. But in relation to the Belgian patent, plaintiff says this means that the wrinkles to be removed must be those which have already been stuck to the core, while in the case of his own patent, his contention is the opposite. He insists that the rollers 30 of the Belgian patent must have acted throughout the entire sides of the core or that there would not be any wrinkles or puckers formed for the spinning rolls of Fig. 6 to remove. But the language of his own Seiberling

and Stevens patent shows that wrinkles are formed in the skirts of the fabric by the mere operation of shaping it to the tread and part way down the sides of the core, and his own exhibit pictures of the Goodyear commercial machine show the same thing (Vol. II, p. 191).* And even in connection with the State patent in suit, Browne admits that if the fabric is stretched circumferentially on the core and the tread roll then used, the skirts of the fabric are in a loose and baggy condition which can be described by saying that they are in the form of "puckers", and he unqualifiedly admits that prior to the step of operating the spinning rolls there are puckers or corrugations in the unattached portions or skirts of the fabric, which puckers or corrugations do not exist after the operation of the spinning rolls (Vol. I, p. 510, x-Qs. 132, 134). Hence, the spinning rolls of the State patent are necessarily for performing this same function of "removing the puckers". In view of these statements and admissions as to the operation of the Seiberling and Stevens and State patents, we confidently submit that the interpretation Browne puts on this language of the Belgian patent is inconsistent and unfounded.

The natural interpretation is that the puckers or wrinkles are formed in the unattached fabric edges or skirts, and this is the actual fact in operation. Thus formed, they are removed by the action of the spinning rolls of Fig. 6, just as the patent recites.

Our position finds further support in the testimony of Duncan, who says that his concern (the Hood Company) obtained some of these machines from Matherne in 1910 and 1911 (Vol. I, p. 203,

* *Supra*, page 45.

x-Q. 63). He was cross-examined as to the operation of the rollers 30, as follows (p. 204):

> "x-Q. 66. Please tell me how the pairs of reciprocating rollers 30 last referred to operated on the fabric already stretched on the core?
>
> "A. They were used to apply the fabric down to the neutral line of the fabric, approximately the center of the side of the core."

The Belgian patent describes the result of the action of the Fig. 6 rollers which spin down the loose skirts or edges of the fabric saying (Vol. II, p. 220, line 4 from bottom):

> "Thus there is obtained the complete and rapid removal from the fabric of the puckers,".

This is exactly what happens and is exactly what is shown by an examination of photos 10, 11 and 12 (*ante*, p. 111) of Defendant's Exhibit D. Furthermore the Belgian refers to this action as:

> "producing a progressive removal from the fabric of the puckers by eliminating the puckers from the point of their origin, this being performed in a single descending movement" (Vol. II, p. 221, line 13 from bottom).

The photos just referred to correspond exactly to this description, for it will be seen that photo No. 10, shows the spinning rollers of Fig. 6 beginning their operation at the **point of origin** of the puckers, and the next two photos show their progressive elimination in a single descending movement. While the Belgian patentee refers many times to this spinning roll of Fig. 6 in the singular, as does State, he says distinctly that

> "Both sides may be readily worked at the same time, by mounting two tools like that shown in Fig. 6 on the sliding tool carrier 17" (Vol. II, p. 220, last line).

The whole foundation of plaintiff's theory is contrary to long established principles. The cases most often relied upon by plaintiffs in these instances are those following the well known doctrine of *Topliff* v. *Topliff*, 145 U. S. 156, in which is said that a prior device is not anticipatory if it was not "designed by its maker nor adapted, nor actually used" to perform the function of the patented patent. But the plaintiff here overlooks the fact that not even he has been able to dispute that the machine of the Belgian patent is *adapted* to perform the function which he attributes to the machine of the patent in suit. Defendant says that it was designed to perform this function, but it does not need to go this far because the Belgian patent is anticipatory if it can be operated to perform the function of the machine of the patent in suit, and even though ordinary mechanical changes are required. As said in *Barber* v. *Otis*, 271 F. R. 171, 177 (C. C. A., 2):

> "If the mechanism made under the prior art patent is capable of producing the same results, or is designed, adapted, or used to produce the same results or perform the same function, it may be successfully set up as an anticipation."

See also *Dashiell* v. *Grosvenor*, 162 U. S. 425, 432; *Pickering* v. *McCullough*, 104 U. S. 310, 319; *Cohn* v. *U. S.*, 93 U. S. 366, 377; *Century* v. *Wagner*, 192 F. R. 564, 565 (C. C. A., 8); *Van Epps* v. *United*, 143 F. R. 869, 874 (C. C. A., 2); *Standard* v. *Standard*, 223 F. R. 779, 786; *Ironclad* v. *Dairyman's*, 143 F. R. 512, 515 (C. C. A., 2).

Plaintiff says the Belgian patent was a "paper patent". This is not a fact because, as already noted, the exhibit machine here in evidence with

the spinning rolls of the Belgian patent was commercially offered to the Hood Company by Matherne in 1911 (Vol. I, p. 204); and the exhibit machine was actually used later on in the Firestone factory for the production of commercially satisfactory tires (Vol. I, p. 160). In any event, this claim of defendant is unimportant, in view of the decision in *Pickering* v. *McCullough*, 104 U. S. 310, 319, in which this Court said:

> "It is objected, however, that the machines described in these patents are mere paper machines, not capable of successful practical working. But on examination it sufficiently appears, we think, that the objections can be sustained only as to minor matters of detail in construction, not affecting the substance of the invention claimed, and could be removed by mere mechanical skill, without the exercise of the faculty of invention. In this view, the Wise and Smith patents are not rendered inefficient as defences in this suit, by reason of the alleged imperfections of the machines described in them."

Appellant argues as though different standards of criticism apply to the disclosures of the prior art and the patent in suit. This is not the law. This Court said in *New York* v. *Chain*, 254 U. S. 32:

> "We yield to the assertion of counsel that he [patentee] cannot be deprived of an advantage because he did not discern it, but the same concession must be given to Murray [prior art]. He was entitled to all of the benefit that he claimed for his device, or that can be given to it by formal changes.

See also *Knapp* v. *Morss*, 150 U. S. 221, 227; *National* v. *Interchangeable*, 106 F. R. 693, 708 (C. C. A., 8); *Fuller* v. *Yentzer*, 94 U. S. 299; *Wessel*

v. *United*, 139 F. R. 11, 15 (C. C. A., 6); *Appleton* v. *Star*, 60 F. R. 411, 415 (C. C. A., 7).

Plaintiff's expert's criticism of the Belgian patent is founded almost entirely upon the alleged action of the rolls 30 But it has been shown by Waterman that the machine operates perfectly even if these rolls be entirely omitted (Vol. I, p. 280, Q. 69). Browne answers this by saying that there is no suggestion in the Belgian patent, that the rolls 30 can be omitted (Vol. I, p. 476, Q. 60). But the Belgian does say that these rolls can be "placed at any desired point on the core"; *i. e.*, they may be used simply on the edges of the tread portion, if desired. There is no suggestion in the State patent that the tread roller can be omitted (Vol. I, p. 513, x-Qs. 152, 155). Yet Browne says that the mode of operation which he ascribes to the machine of the State patent in suit is carried out with the tread roller omitted (Vol. I, p. 513, x-Q. 151). He has to say this because defendant's machine employs no tread roller. Thus his whole treatment of this Belgian patent seems to be hypercritical and inconsistent. The facts are plain and their effect cannot be avoided. **There is no question that the machine of this Belgian patent is a practical tire making machine for making commercial tires.** This is testified to by Thomas, General Superintendent of the Firestone Tire & Rubber Company, and is uncontradicted (Vol. I, p. 161, Q. 14). Commercially satisfactory tires have been made thereon and tested in use (Vol. I, p. 160). Nor can it be denied that Matherne, the patentee of this Belgian patent, was a well educated, technically trained inventor and designer with a thorough knowledge of tire making (Vol. I, p. 196, Qs. 16-20).

The Plaintiff points out that this Belgian patent

was allowed to expire through failure to pay the annual tax. But this is of no legal effect. *Sirocco v. Sturtevant Co.*, 220 F. R. 137, 143 (C. C. A., 2).

On the above showing the claims in suit are void for anticipation.

As already indicated, **the Court of Appeals for the Sixth Circuit disagreed with all the criticisms of the Belgian patent made by plaintiff.** The Court below also apparently disregarded many of them. It apparently agreed with our contention that the rollers 30 merely applied the fabric to the side portions of the core immediately adjacent the tread, because the opinion says (Vol. II, p. 411):

> "by certain mechanism Matherne proposed to unwind the fabric which is advanced to the core, and to stick or plaster it to the tread circumference, or, as the patent states, 'as the fabric is pulled along and unwound from the drum 18 it encounters the rollers 30 on the casing 28 * * * each of these rods carries at its extremity a roller 30 which advances and retracts on the core, so as to stick to its straight or convex sides the fabric which has been placed there.' In addition to thus plastering the tread portion and thereby lengthening the fabric along the line of the *median circumference* of the core, etc.". (Italics ours.)

Judge Buffington's assertion is that the fabric was wrinkled or puckered by the conical gears 36 and that these puckers were stuck to the sides of the core by the rotary movement of the core in drawing the fabric from the source of supply. In this connection Judge Buffington says (Vol. II, p. 412):

> "Moreover, this puckered edge or skirt was not left free as in State, but was plastered

down by Matherne to the side of the core, in that regard the patent saying:

> 'The fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement.' "

This is the only part of the Belgian patent to which the learned Judge refers in support of his contention that the puckers were stuck to the sides of the core instead of being left free, and it is quite apparent that he did not realize that this coating of the core with a rubber solution, or other adhesive substance, has always been the practice both in hand making and machine making of tires. The purpose is to enable the end of the fabric to stick to the core so that it can be drawn along by the rotation of the core, and also to cause the loose edges or skirts of the fabric to stick to the sides of the core when they are pressed against them by the spinning roller. Indeed, the patent in suit makes corresponding statements, specification, page 3, line 55:

> "In order that the ring-core may take hold of the fabric, the core is coated with rubber or cement"

and again on page 6, line 95, where State says:

> "The operation of my machine will now be reasonably clear. As I have before explained, a ring-core supplied with some adhesive material on its exterior portion is placed upon the chuck", etc.

Therefore, we see that there is no proper authority for giving to the corresponding language of the Belgian patent, the meaning which is attributed to it by the Court below.

Additionally, an examination of the bottom portion of Fig. 2 of the drawings of the Belgian patent (Vol. II, p. 227) will show that the conical gears 36 (at the right) are spaced so far apart that they would hold the edges of the fabric out from the sides of the core and thereby prevent them from adhering as the fabric was drawn on to the core from the stock roll.

This being the case, and the Court below having agreed that the rollers 30 merely assist in cementing the fabric "along the line of the median circumference of the core" (*i. e.*, center of the sides of the core) **there is nothing which can possibly prevent the fabric from flying out from the inner sides of the core** (*i. e.*, beyond the tread portion) **under the influence of centrifugal force when the core is rotated at the high speed, as described in the specification,** which is over twenty (20) times the low speed. Hence, the following operation of the spinning roller 17 is necessarily the same as that attributed to the spinning roller of the State patent, and the Court of Appeals for the Sixth Circuit was certainly correct in saying (Vol. 257, F. R. p. 84):

> "the tool of the Belgian patent is a spinning roll, and performs a spinning operation;"

and again

> "the Belgian tool in its radial progress was bound to stretch and re-shape the fabric in substantially the same way that is done by State."

In his opinion, when arguing differences between the machine of the State patent and that of the Bel-

gian patent, Judge Buffington explained that the Belgian (Vol. II, p. 413):

> "deliberately formed puckers [when placing the fabric on the core] and then sought to eliminate them [by his spinning rolls], a procedure wholly different from State, who never formed puckers, and indeed prevented their formation by radial stretch and radial diamond pointed interstices."

And in another place the Judge said (p. 408):

> "Thereby he [State] then, and by the wheels [spinning rolls], pressed and cemented the radially stretched and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge."

To visualize how far the Court below was from an accurate understanding of the fact, we have simply again to refer to the photographs of the Goodyear commercial machines (Vol. II, pp. 189, 191). Who can look at the photograph on page 191* and then agree with Judge Buffington that the centrifugal force generated by the high speed rotation of the core radially stretched the fabric so that "State never formed puckers", when we see nothing but puckers in the loose skirts or edges of every layer of fabric shown on the core? And who can agree, while looking at this picture, that these spinning rolls press the "puckerless fabric" of the tire "clear down to the bead edge"? Relying only upon Plaintiff's demonstration of the commercial machines at his factory, we can unhesitatingly say that State did form puckers in the outlying skirts or edges of the fabric —most prominent and numerous puckers. We can also say that, instead of cementing the alleged puckerless fabric "clear down to the bead edge" with

* Reproduced *supra*, page 45.

his spinning rolls, he only went a little more than half way from the outer circumference to the inner circumference and left the cementing and forming "clear down to the bead edge" to be done by a hand operator resorting to the old-fashioned hand spinning procedure (Vol. I, p. 234). Therefore, the distinctions which the learned Judge draws between the State and the Belgian patent, are not accurate.

Seiberling and Stevens Patent.

(Vol. II, p. 257.)

This is one of the two patents originally in suit and Plaintiff was one of the co-inventors. Although it was strongly relied upon by Plaintiff in the *Firestone* case, and one of its claims there sustained, Plaintiff has not even made a *prima facie* case upon it in the present suit, and State actually disparaged the machine of this patent (Vol. I, p. 306, Qs. 30-32); while the Plaintiff himself said nothing about it.

This machine was described by the Court of Appeals in the *Firestone* case (257 F. R. 76). It is described by Defendant's expert, Waterman, beginning at the bottom of page 255, Vol. I. Briefly, it comprises a core 8 (Fig. 1) which is mounted for rotation at either low or high speed by friction drive mechanism. The fabric is led through tension rollers 43 and 46 (shown at the left) arranged to be squeezed together to increase the tension on the fabric. The fabric is indicated in dotted lines as running from these tension rollers onto the core. The tread roller 17 serves to shape the fabric to the tread of the core, and its edges extend quite well down the sides of the core and are pressed laterally against the core by small rollers 52 held

on the ends of arms 53, which are drawn together by a spring 54; the spring exerting the lateral pressure.

The fabric is next acted upon by a pair of fingers 85 which reciprocate on the core in a radial direction, and shape the fabric to the sides thereof. These fingers are laterally pressed against the core during their inward movement by the mechanism connected therewith. Following the action of these fingers, the edges of the fabric are stitched in at the base of the core by the stitching rollers 91. These rollers are shown on an enlarged scale in Fig. 4 and are laterally pressed against the core by the workman pulling downwardly on the handle of the lever arm 93. Furthermore, these rolls may be moved radially with respect to the core by the same means, the apparatus which supports them swinging about the pivot 38. It is obvious that these stitchers are similar to State's spinning rolls and that they can readily be caused to act upon the sides of the fabric at the inner portion of the core. Indeed, Plaintiff is *estopped* to assert that these devices can perform the function of spinning rolls, because in the Bill he charged infringement of claim 14 of this patent (which covers the mechanism just described) by the forming rolls of Defendant's machine which he also says are the same as the spinning rolls of the State patent. It should be noticed that these stitching rollers 91 are mounted at a receding angle to the plane of the core, as mentioned in a few of the claims in suit. The Court of Appeals said in the *Firestone* case (257 F. R. 83):

> "The Seiberling and Stevens patent shows what it calls creasing or stitching rollers. Each one is undoubtedly an effective spinning

> tool and capable of use as such; their edges, as shown, may be sharp enough to cause some danger of cutting the fabric, but the spinning would be done by the side bevels, not by the extreme edge; and plaintiff's theory that defendant's spinning roll is so far the equivalent of the Seiberling and Stevens stitching rolls as to make out infringement of the claim based thereon goes far to persuade that they are, in a broad sense, an anticipation of State's spinning roll. There seems no sufficient reason to doubt that Stevens used them for spinning in 1903 or 1904."

Thus, this patent includes a power driven ring core, a fabric supply and means for exerting tension thereon, a tread roller for shaping the fabric to the tread, radially moving fingers for shaping part of the fabric to the sides of the core, and radially moving laterally pressed stitchers or spinning rolls which are adapted to spin down the remainder of the fabric. There is also an arrangement for low speed and high speed rotation of the core.

Plaintiff's brief below (pp. 18, 19) treated the Seiberling and Stevens machine as a failure. It said that after the fabric had been stretched circumferentially it was "sought to stretch the skirts radially and apply them to the sides of the core, and for this purpose they employed a pair of jigger fingers" but that "the effort failed" and the machine "was finally abandoned and junked". In the *Firestone* case, the brief (p. 20), prepared by this same counsel, referred to the action of the said jigger fingers as follows:

> "These fingers, as in hand operation, serve to stretch the fabric radially, to smooth out the wrinkles and to lay the fabric conformably along the core."

On page 21, it was referred to as a "valuable apparatus".

Plaintiff's expert said in this case (Vol. 1, p. 486):

> "Circumferential stretch is obtained when drawing the fabric onto the ring-core. Radial stretch on the skirts of the fabric is achieved by the reciprocating action of the jigger fingers 85."

The trial Court in the *Firestone* case, after seeing the machine of this patent in operation said (234 F. R. 371) that

> "it was decidedly an advance step in the art and so far occupied the field that it anticipated, in a large measure",

the State invention. The Court of Appeals for the Sixth Circuit, after also seeing the said machine in operation, said (257 F. R. 80):

> "State's machine was of the same general type as Seiberling & Stevens."

Judge Buffington, without analyzing this patent and without seeing the machine in operation, dismissed it with the statement that it was "of wholly different type" from the State machine.

We submit that this patent must necessarily limit the State patent to its specific details, and that Plaintiff's attempt in this case to weaken the force of this patent by State's testimony in disparagement thereof, is not only inconsistent with his position in the *Firestone* case; but that he is *estopped* to deny full force to this prior patent because of his ownership of it and its joinder with the State patent in the Bill of Complaint, in which he said, under oath, that the invention of this patent was "of great benefit and advantage to the public" (Vol. I, p. 3).

Vincent Patent.

(Vol. II, p. 245.)

This patent is for a tire making machine of the same kind as the State patent; and the machines were in commercial use, both here and abroad, before State's alleged invention (Vol. I, p. 187, *et seq.;* pp. 388, 389).

Waterman described this patent (Vol. I, p. 254) and Browne is in substantial agreement (Vol. I, p. 482, Q. 69). It shows a core represented by a large circle in Fig. 1. There is a stock roll 13, at the right, and between the stock roll and the core are rolls 16 and 17, which are geared to each other so as to "stretch" the fabric (Pat., p. 1, line 17). These rollers are convex, as in many of the Goodyear commercial machines, so as to cause the fabric to more readily conform to the tread of the core. After the fabric has been thus stretched and shaped to the tread portion of the core, its edges or skirts are formed to the sides by means of hammers 30 which are laterally spring pressed towards the core, and arranged to operate, one after the other, in an inward radial direction. As Waterman said (Vol. I, p. 255):

> "These hammers act progressively radially inward as the core with the fabric applied to it rotates, thus laying the fabric smoothly against the core with a progressive inward radial action."

This patent discloses all the elements of claims 4, 5, 6, 7, 22, 23, 24 and 25, except that the specific device of radially acting sets of hammers is substituted for the radially moving spinning rolls. The only additional difference between this machine

and claims 12 and 13 of the State patent is that the Vincent machine does not show high and low speed mechanism; and the only difference between the Vincent patent and claim 26 is that the fabric is not drawn from the source of supply in a flat condition and the support for the hammers is not a sliding one. But these last named features are all shown in the Seiberling & Stevens patent, so that it did not amount to invention to embody them in the State machine. *Stimpson* v. *Woodman*, 10 Wall. 117, 120, 121; *Adams* v. *Bellaire*, 141 U. S. 539; *Mast* v. *Stover*, 177 U. S. 485; *Rich* v. *Baldwin*, 133 F. R. 920, 922 (C. C. A., 6); *Overweight* v. *Henry*, 102 F. R. 957, 961 (C. C. A., 6); *Campbell* v. *Duplex*, 101 F. R. 282, 294 (C. C. A., 6); *Jacobs* v. *Almond*, 177 F. R. 935, 936 (C. C. A., 2); *Archer* v. *Imperial*, 207 F. R. 81, 82 (C. C. A., 2); *Wilson* v. *Frank*, 173 F. R. 619, 622 (Colt, *J.*); *United* v. *Sturtevant*, 122 F. R. 470, 474; affirmed 125 F. R. 378 (C. C. A., 1); *Sieber* v. *Chicago*, 184 F. R. 930, 931 (C. C. A., 7); *Wisconsin* v. *American*, 125 F. R. 761, 767, 768, 769 (C. C. A., 7), see cases cited; *Voigtmann* v. *Weis*, 133 F. R. 298, 302, affirmed 148 F. R. 848 (C. C. A., 8).

Chief Claims of State Patent were Granted Because Patent Office was Misled by Plaintiff.

During the prosecution of the application for the State patent, pending claims 4 to 10 (corresponding in subject matter to claims in suit Nos. 4, 5, 6 and 7), were rejected upon this Vincent patent (Vol. II, p. 365). Following this rejection, these claims were cancelled, but again presented

with merely formal changes (Vol. II, pp. 371, 373). State also inserted claims in suit 22, 23, 24, 25 and 26 (Vol. II, pp. 379, 381) which, as already indicated, are substantially identical with claims 4 to 7 inclusive. The remaining claims of the patent were rewritten at this time. This amendment and presentation of claims by the applicant was not accompanied by any written argument in support of the novelty of the claims. But it was supported by affidavits of Plaintiff and State.

State said (Vol. II, p. 385):

> "I am informed and believe that a machine about as shown in the Vincent patent # 794,473, and employing hammers for shaping the tire fabric on the sides of the ring core, has been used in this country, but that it proved unsatisfactory and was abandoned."

Plaintiff said (Vol. II, p. 389):

> "As president of the Goodyear Tire & Rubber Company, it has been my business to keep informed in the art of making Pneumatic Tire shoes, and I have kept myself so informed by discussing the state of the art with the various competitors of the Goodyear Company, by visiting other factories where Tire Shoes are made, and by reading the trade journals.
>
> * * * * *
>
> "Affiant has, furthermore, been informed from several responsible sources and believes that a machine like that of the Vincent patent # 794,473, employing a set of hammers to shape the fabric on the sides of the ring core, has been actually tried in one of the large tire making factories and that its use has been abandoned."

As a result of these affidavits, the Patent Office allowed the claims here in suit. The obvious pur-

pose and effect of these Affidavits was to show that the machine of the Vincent patent was not a practical machine and that, therefore, it should not be used as an anticipation of State's application. But the fact was the contrary, and the record shows that Plaintiff's information was to the contrary. Presumably State's was also, because of his close association with Plaintiff.

As showing that the fact was the contrary reference is made to the testimony of Raymond (Vol. 1, p. 187). He is the vice-president in charge of production at the B. F. Goodrich Company, and shows that one of these Vincent machines was obtained by his company and operated on a large commercial scale for about a year. It was an entirely satisfactory machine and made perfectly good tires.

As showing that Seiberling was not frank with the Patent Office in his statements in this Affidavit, and that State presumably followed this same course, reference is made to a letter which is printed on pages 401 and 402, of the Record, Vol. I. Plaintiff was asked the purport of the letter (Vol. I, p. 388, Qs. 21-24), and said:

> "I had learned of a machine used by Pirelli & Company, in Milan, known as the 'Vincent' machine; and I had a talk with Pirelli about it; and I wrote my brother concerning it, and stated that I thought of negotiating with Vincent for United States rights."

This letter was written by Plaintiff in August, 1907—some two years before he made his Affidavit to the Patent Office. At that time Plaintiff was a Director and General Manager of the Goodyear Company and his brother was Secretary thereof

(Vol. I, p. 413; Rd-Qs. 207, 208). Plaintiff wrote as follows (Vol. I, p. 401):

> "I have just come from a meeting with Mr. Pirelli. They have one of the tire machines invented by a Frenchman which makes *four tires per hour* up to the cover. He claims it works perfectly putting the fabric on at uniform tension, the beads accurately located, with a saving in material." (Italics ours.)

Plaintiff also admits that he never saw the Vincent machine at the Goodrich Company and that he cannot testify of his own knowledge that it was only used part of one year and then thrown into the scrap heap (Vol. I, p. 409, x-Qs. 179, 180) although he had testified on direct that he knew this (Vol. I, p. 396, Q. 69).

Owing to the position of Plaintiff in the industry, the Patent Office Examiner doubtless gave great weight to his inaccurate Affidavit. Doubtless it caused the Examiner to withdraw the Vincent patent as an anticipation and allow the most important of the claims here in suit. To the same effect was State's affidavit, but we cannot impute to him direct information as to the practicability of the Vincent machine. We can only presume that he had knowledge of the fact from the presumption that the contents of Seiberling's letter from Italy would naturally have been discussed with him. This deception of the Patent Office not only affects the weight to be given the Plaintiff's testimony. It shows that if the Patent Office had not been persuaded to regard the Vincent patent as an impractical one, it would have continued the rejection of the claims referred to and not have granted State's patent in its present form.

Moore Patent.

(Vol. II, p. 273.)

This patent has become very pertinent in this case in view of Plaintiff's contention that the Disclaimer changes the claims in suit to combinations of a high speed core and a spinning roll (Brief below, p. 7). Moore unquestionably shows this combination.

This is a patent for making tire casings. It discloses an expansible core 49 upon which an endless band of rubberized fabric is intended to be placed. This fabric is stretched by expanding the core. Following this stretching the core is rotated by power at high speed and the fabric is rolled down by a set of rollers, one of which is a spinning roller 47. This roller is mounted on an arm 40 which is pivoted so as to swing in a radial direction with respect to the core.

The operator seizes this arm and causes both the radial and lateral movement of the spinning roller in working on the fabric. Waterman describes this patent beginning Vol. I, page 257.

In the *Firestone* case the Court of Appeals said (257 F. R., at p. 83):

> "The Moore patent shows what is, essentially, a spinning roll for operating against a revolving core in making a tire casing. It was intended to and did smooth down the Moore tire from the center of the tread only part way, and not much further than may be done by the typical tread-forming roll; but the operation is substantially spinning, as far as it goes, and involves, in some degree, the characteristic relocation of the threads of the fabric, even though it may only put them back

> where they were before the casing was distorted by placing it on the core. In the Moore patent, the handle of the spinning roll was so attached to its frame that the roller could not effectively travel radially of its core down as far as the bead, but if its attaching staple is made larger, the whole tire can be formed thereby as demonstrated."

Waterman says, beginning at the bottom of page 258, Vol. I:

> "The specification does not limit the use of the machine to any one particular form of core and it is obvious that any of the forms now in use might be employed. The specification expressly states, page 2, line 107, that it may be 'of any other desired and approved shape'."

The specification of the patent also says that

> "the rotation [of the core] is kept up at a high rate of speed during the performance of the operations" (Vol. II, p. 281, line 73);

and that the spinning rolls are

> "successively brought into action, smoothing and stretching the said wings [of fabric] into proper position and condition" (Vol. II, p. 282, line 24).

thus describing the high speed of the core and radial stretch of the fabric.

We submit that this patent necessarily eliminates any patentability from "the combination of the forming or spinning-roll with the high-speed core", which Plaintiff said in his brief below (p. 7) is "The only thing" left in the State patent after the filing of the Disclaimer.

The Sixth Court of Appeals did Not Rely Upon the Defense of Aggregation Alone.

Judge Buffington devotes several pages of his opinion to an argument that the *process* which he attributes to State embodies inter-related steps and is not, therefore, an aggregation; whereby he concludes that the Court of Appeals for the Sixth Circuit was in error in holding that most of the claims of the State patent, when considered as machine claims, were for aggregations. Thus, after lengthy discussion, Judge Buffington says (Vol. II, p. 408):

> "it follows that the process is a unitary one, is a continuous one, is an inter-related one, is an undivided one."

We feel that the learned Court below must have misunderstood the position of the Court of Appeals for the Sixth Circuit, because the latter Court expressly notes that the defense of aggregation does not apply to a process, and that it would be somewhat artificial to invalidate a patent on the ground of aggregation, if the same monopoly might have been obtained by a method patent, and that, therefore, the Court preferred to go further and show that, considering the State patent as for a method, it was anticipated. The exact language of the Court in the *Firestone* case was as follows (257 F. R., p. 82):

> "but plaintiff really presents his case on the theory that State discovered a new method of making tire casings or a new set of functions to be performed by associated mechanism. Although a mechanical patent may not be granted for a function (*Westinghouse* v. *Boyden Co.*, 170 U. S. 537, 18 Sup. Ct. 707, 42 L. Ed. 1136), yet it is now settled that a

> method patent may be granted for an association of successive mechanical steps (*Expanded Metal Co.* v. *Bradford*, 214 U. S. 366, 29 Sup. Ct. 652, 53 L. Ed. 1034), and to hold a mechanical patent void for aggregation, when the same monopoly sought by the patent might have been obtained through a method patent, seems somewhat artificial; hence, we prefer to point out also that State had nothing broadly new either in his method or in his selected tools;"

There is nothing in the majority of opinion of the Court below to indicate that it gave thought to this fact, although Judge Davis, in his dissenting opinion, expressly takes notice of it.

State was Not the Sole Inventor of His Patent and it is, Therefore, Void.

It is settled law that a sole patent granted for a joint invention is void (*McKinnon* v. *American*, 268 F. R. 353, C. C. A.; *Thomas* v. *Weeks*, 1 Fish. 5; 23 Fed. Cas. 978, 981, No. 13,914; *Barrett* v. *Hall*, 1 Mason, 447; 2 Fed. Cas. 914, 924, No. 1,047; *American* v. *Newgold*, 108 F. R. 957, 959; *Bannerman* v. *Sanford*, 99 F. R. 294, 298; *Smart* v. *Wright*, 227 F. R. 84, 87).

In the present case the patent was granted to Plaintiff upon an application filed by State. The Answer raises the defense that State was not the sole inventor of this invention but that it was jointly invented by State and others. The cross-examination of State on rebuttal developed facts which are submitted to fully support this defense. As this evidence proceeds from the mouth of the alleged inventor, it constitutes the best evidence of the facts and cannot be disputed by Plaintiff.

We shall now analyze claims of the patent and the testimony of State to establish our proposition that he was not the sole inventor of the subject matter of the patent. One of the characteristic claims reads as follows:

> "An open tire-shoe making machine comprising the combination of
>
> a sheet-fabric supply,
> a power-driven ring-core,
> a radially moving support laterally spring-pressed toward the core,
> and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core."

State says that the hand spinning method of making tires was demonstrated to him by one McDonald at the outset and that it constituted a part of the experiments (Vol. I, p. 309):

> "Q. 56. You say that you started a series of experiments sometime in the year 1907, with the idea of obtaining a commercial machine. Did McDonald's demonstration and illustration of this hand spinning method form any part of these experiments?
> "A. It did."

Therefore, State cannot be held to be the inventor of this method.

The first of this series of sketches to show a power drive for the core, is the one entitled "4th device" (Vol. II, p. 71). But this was not State's idea (Vol. I, p. 345).

> "x-Q. 374. Who made the suggestion for the belt drive?
> "A. Thomas made it."

In this sketch the power drive is marked P and W, and the inscription refers to "power-drive P and W, pulleys selected to suit R. P. M. of K". K is the core. Thus Thomas not only suggested the provision of this power belt drive, but also the variations of pulleys in order to obtain different speeds of rotation (R. P. M.) of the core. It must be emphasized that this is not a case in which State made the suggestion of a power drive and Thomas merely did the mechanic's part of providing a pulley and belt in order to connect the device with a source of power. It is a case in which *the original suggestion came from Thomas*, and State, apparently, did not even do the mechanical part. Plaintiff's brief below (p. 47) says:

> "This is the first instance of the core being driven by power,".

Therefore, Thomas was plainly the inventor of this element of the said claim and hence, a joint inventor with State of the whole combination of the claim.

Up to this stage of the experiments, the fabric had been formed down on the sides of the core by the use of a spinning roll or stitcher held in the hands of the operator, even though the core was rotated by power. But later it was suggested that the spinning roll be mechanically mounted on handles made like a pair of tongs, as shown at S in the lower left hand corner of the sketch marked "sketch—7" (Vol. II, p. 77). As to this development State testifies (Vol. I, p. 348):

> "x-Q. 407. In sketch 7 who made the tongs S?
>
> "A. Charley Wattelworth made the sketch,—draftsman; a man named McBride, a foreman of the blacksmith shop, forged them out."

Wattelworth also suggested the employment of a spring so that the support upon which the spinning rolls were mounted should be "laterally spring pressed" toward the core, as required by the claim (Vol. I, p. 355).

> "x-Q. 485. Who made the suggestion for that spring?
> "A. Charley Wattelworth."

The patent shows these supports for the spinning rolls as being separately pivoted, and State admits that it was Wattelworth who first suggested this arrangement, as shown at the bottom of sketch 9 (Vol. II, p. 85; Vol. I, p. 358):

> "x-Q. 517. And who suggested pivoting the arms which carry the spinning-rollers separately, as in sketch 9, instead of on one pivot, as in sketch 8?
> "A. There was a template made for those arms.
> "x-Q. 518. Of sketch 9?
> "A. Yes. In fact, several templates were made for different types of arms in the drafting room, cut out of pasteboard; and I believe that Wattelworth suggested those pivoted in that position."

Certain claims of the patent in suit, *e. g.*, No. 5, refer to the mounting of the spinning roll on the support at a "receding angle" to the plane of the core. State admits that this arrangement of the spinning rolls was worked out by himself and two others (Vol. I, p. 379):

> "x-Q. 727. Who first suggested mounting the stitcher-rollers at a receding angle with respect to the plane of the core?
> "A. That was determined by the attempt to roll the fabric down and clear the skirt. The

angle was put out as far as it could be and avoid hitting the skirt, to get as much pressure direct on the side of the core as you could possibly get.

"x-Q. 728. Who determined that?

"A. That was determined in our experiments.

"x-Q. 729. Who conducted those experiments?

"A. Three of us. That is,——

"x-Q. 730. That is,——

"A. The machinist.

"x-Q. 731. Thomas, Wattelworth and yourself?

"A. Who?

"x-Q. 732. Thomas, Wattelworth and yourself?

"A. No; Thomas——

"x-Q. 733. McDonald——

"A. McDonald.

"x-Q. 734. And yourself?"

From the foregoing, it will be observed that State has admitted that definite and important elements of the combination of this claim 4 were suggested and worked out by others; and that certain elements were suggested by him but put into practical form by others. In view of the fact that this testimony came from the alleged inventor of this patent, who is the assignor of this Plaintiff, its force is necessarily binding upon Plaintiff, and the admissions so distinctly attribute several features to the inventive activities of others, whether that activity be referred to as "suggesting", "drawing", "designing", or "working up", that the fact of joint inventorship is established, and the patent, wrongfully applied for by State alone, is void.

It should be emphasized that this is not a case where one party employed another to make an invention for him. These other men were not

employees of State. All of them, including State, were employees of the Goodyear Company. Hence, the doctrine sometimes applied, that an invention developed by an employee adheres to his employer, is not pertinent to this case.

In *Cheshire* v. *Cox*, 229 F. R. 415, 419 (C. C. A., 7), the Court said:

> "We are not impressed with appellee's contention that the invention was not a joint one. That both patentees worked upon the combination and contributed ideas which were incorporated therein is plainly disclosed in the record. The combination is a unit. Each element pervades the whole of the basic features of the patent. Brewer contributed the adjustable feeder fingers and the curving of the base plates with its edges upward. Cheshire supplied the other items of the combination."

In *Vrooman* v. *Penhollow*, 179 F. R. 296, 308 (C. C. A., 6), the Court said:

> "It would constantly be happening in the case of joint inventions that the illuminating idea was seen by one before it was seen by the other. But between that and the issuing of the patent there is in many instances a long stretch of time devoted to experiments and the consideration of the form or forms in which it may best be used."

In *Chase* v. *Chase*, 1873 Dec. Com. Pat. 99, 100, the Commissioner of Patents said:

> "This is the ordinary process of joint invention. It is the result of the mutual contribution of the parties. If one suggests an idea in a general way and the other falls in with it, and by his aid develops it and gives it definite practical embodiment, the two may be considered joint inventors."

To the same effect are *McKinnon* v. *American*, 268 F. R. 353 (C. C. A., 3); *Thropp* v. *de Laski*, 226 F. R. 941 (C. C. A., 3); *Gottfried* v. *Phillip*, 5 Ban. & A. 4; 10 Fed. Cas. 841, 843, No. 5633; *Smart* v. *Wright*, 227 F. R. 84, 87 (C. C. A., 8); *Worden* v. *Fisher*, 11 F. R. 505, 506; *Quincey* v. *Krause*, 151 F. R. 1012, 1017 (C. C. A., 6); *Sawyer* v. *Edison*, 1883 Dec. Com. Pat. 80, 85; *Carter* v. *Perry*, 1875 Dec. Com. Pat. 111, 116; *American* v. *Wood*, 189 F. R. 391, 395, 396.

Plaintiff relies upon *Agawam* v. *Jordan*, 74 U. S. 583, and the passage which he quotes from the decision in that case is one familiar to all patent lawyers. But the decision of the case is not in point here, since the claim made by the defendant in that suit was that the patentee had no part in the invention. It was claimed that another party was the sole inventor. This Court took particular pains to point out this fact and said on page 604:

> "Respondents do not allege in the answer that the person named was a joint inventor with the original patentee,".

The remaining claims of this patent which are in suit, are subject to the same defense and need not be specifically considered.

Instead of being the sole inventor of this subject matter, State was but one of several joint inventors. It is legitimate to assume that he made use of his position of authority to exclude his associates from their share as inventors. By so doing he violated the law and his patent is void.

Non-Infringement.

Defendant's machines are constructed under patent No. 1,119,326, applied for January 24, 1912, issued December 1, 1914 (Vol. 2, p. 39).

Several decisions of this Court have held that this fact raises a presumption of non-infringement or, at least, a presumption of substantial difference between Defendant's structure and that of the patent in suit. *Corning* v. *Burden*, 15 How, 252, 270; *Miller* v. *Eagle*, 151 U. S. 186; *Boyd* v. *Janesville*, 158 U. S. 260; *Kokomo* v. *Kitselman*, 189 U. S. 8, 23. In the last named case, this Court said:

> "The presumption from the grant of the Letters Patent is that there was a substantial difference between the inventions."

This is an elaborate patent containing seven pages of drawings, seven pages of specification and one hundred and forty-eight claims. It was introduced in evidence by *plaintiff* and referred to by the experts on both sides in discussing defendant's machine, and as descriptive of it.

We will discuss the subject of non-infringement under separate points as follows:

I.

The proofs fail to show infringement of the interpretation which Judge Buffington has given to the State patent for the purpose of saving it and, in fact, disprove infringement of such interpretation. Judge Buffington expressed this interpretation as follows:

> "the crux and dominating functional feature of State's machine is the use on the fabric of a *centrifugal force* caused by the rapid rota-

tion, a process which is wholly different from the original hand process." * * *

Here he (State) changed to something the old hand process had never used, namely, the machine was *speeded up* to a point where the revolution of the wheel and flying skirt of of the uncemented loose fabric *stretched itself radially* and thereby formed radial, diamond-shaped interstices, which contracted the normal length of the fabric" (Vol. 2, p. 408).

"the rapid rotation of the core and the consequent exercise of *centrifugal force* on the covering material *by which it is automatically* gradually *stretched* radially" (Vol. 1, p. 407).

"we are satisfied that *the utilization of centrifugal force to stretch the fabric* and the action of the spinning rolls upon a centrifugally, automatically stretched fabric, was an entirely new combination which State brought into the tire art" (Vol. 2, p. 411). (Italics ours.)

In order to bring defendant's machine within this interpretation Judge Buffington was forced to find that defendant's machine contained

"the loose edges *stretched by the centrifugal force* induced by rapid core rotation * * * the use of spinning rolls cooperating with the *centrifugal radial stretch* of the fabric" (Vol. 2, p. 414). (Italics ours.)

This finding as to defendant's machine has no support in the proof and is contrary to all the proof in the record, as well as contrary to the laws of physics. Correcting this error of fact, it is evident that defendant's machine does not infringe Judge Buffington's interpretation of the patent and, therefore, that his opinion becomes an authority for non-infringement instead of infringement.

We defy plaintiff to refer to any evidence that in defendant's machine the loose edges are "stretched

by the centrifugal force induced by rapid core rotation", or that there is any "centrifugal radical stretch of the fabric", or that in comparison with the hand method the rotation of the core is substantially "speeded up" or varied in any way productive of a different function, mode of operation or result.

In the hand method whatever radial stretch resulted was produced by the spinning wheels and in defendant's machine it can only be by the spinning wheels, if there be any at all, as we say there is not when normally operated. Even plaintiff's expert attributed the radial stretching, which is alleged to exist in defendant's machine, to the spinning rolls and not to centrifugal force saying (Vol. 1, p. 494):

> "in defendant's machine, the tread zone of the fabric is shaped by circumferential stretching and the sides of the fabric are formed by *radial stretching due to the action of the spinning rolls.*" (Italics ours.)

On cross-examination, plaintiff's expert was forced to admit that his allegation of any radial stretching in defendant's machine was a mere inference (Vol. 1, p. 72) saying: "I so infer" and "I assume", and admitting that he had made no tests to prove his assumption (Vol. 1, p. 515).

On the other hand, defendant's expert Waterman testifies, after tests, that in the normal operation of defendant's machine there is no radial stretch, saying (Vol. 1, pp. 278-279):

> "Certainly not always, and so far as I have any information it does not at all. Of course an elongation of the mesh where the fabric is stretched over the tread portion is inevitable as a result of the [circumferential] stretching,

but I have never seen or been able to ascertain from anyone else that there is any distortion of the fabric meshes on the sides into diamonds having the longest dimension radial. I have carefully examined the fabric after being fully applied to the core by defendant's machine, but have not been able to detect any such action with the aid of a magnifier intended for examining the fabric and with a focal length of a little over one inch. This glass shows the elongation of the meshes on the tread due to [circumferential] stretching, but it does not show any radial elongation at any portion of the fabric."

Although plaintiff's expert was called in rebuttal, he failed to rebut the above testimony of defendant's expert in any particular either by tests or examination.

It will be observed that whatever disagreement there is between the experts is only in attributing radial stretch to defendant's spinning wheels and that neither of them in the least support the assumption of Judge Buffington attributing radial stretch to the centrifugal force as the gist of the State invention.

We have already (*supra*, p. 99) cited the testimony showing that the rotation of defendant's core is not materially different from the hand rotation, an example being the following, testimony of Walch (Vol. 1, p. 291):

"x-Q. 53. Do you think the speed of rotation that you gave the core by hand was as great as that now present in the operation of the Thropp machine? Do you understand the question?

A. Yes. Well, it is very near the same; there was not much difference; you can twist the core just as fast as the Thropp machine."

It should be borne in mind that defendant's machine does not attain the speed mentioned in the State patent or anything like it. The State patent says (p. 2, line 4):

> "I have discovered, however, that it is not only possible but highly desirable to let the smoothing and spinning rolls operate upon the ring core while this is moving at a much higher speed, say at 207 turns a minute."

The speed of the defendant's core is only 130 (Vol. 1, p. 277) and defendant's expert Waterman says

> "defendant's machine does not employ the high speed provided in the State patent" (*Id.*).

II.

Since the method or mode of operation of defendant's machine does not differ from the old hand method in any of the respects that Judge Buffington attributed to the State patent, it also follows that no patent covering Plaintiffs' machine can be entitled to a broad interpretation covering all kinds of mechanism by which the hand method may be simulated. In other words, no inventor coming after the old hand method could obtain a patent covering all mechanism simulating the hand method. At most, he could only obtain a patent for the specific mechanism, if new, by which he simulated it. The desirability of simulating the hand method by mechanism was, of course, obvious, and the only problem was to devise a particular mechanism by which it might be simulated.

Since, therefore, it appears that defendant has not followed State in any departure from the hand method, it follows that defendant cannot infringe the State patent, unless it has taken some specific

mechanism invented by State and novel. In other words, the question of infringement must be considered from the point of view of specific mechanism and not from the broader point of view of process.

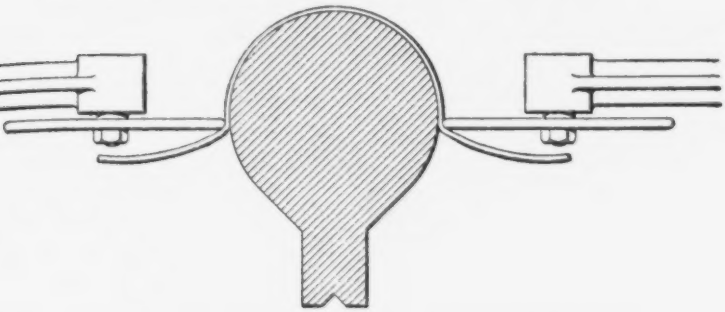
III.

In what follows we show that, viewed from the light of the last above point, the mechanism of defendant patented by the 148 claims of its patent (Vol. II, p. 39) is totally distinct from that described in the State patent, in fact, the two mechanisms are as different from each other as it would be possible for two mechanisms to be, which were intended to simulate the operation of the hand process.

The State patent shows and describes the spinning rolls as being mounted at a receding angle to the plane of the core, *i. e.*, they recede at an acute angle outwardly towards the periphery of the core. The construction of Defendant's machine is such that the spinning rolls are slidable on a curved element so that their angle with respect to the core can be changed, and the patent on Defendant's machine, put in evidence by Plaintiff, shows that it is intended that the rolls shall work at about right angles with respect to the fabric on the core (Vol. II, p. 44, line 108). In Figure 14 of this patent (Vol. II, p. 38), the rolls are shown in two angular positions; one, in full lines, indicates the operation on the edges of the tread portion at a receding angle, and the other, in dotted lines, indicates the operation on the beads of the tire at an entirely different angle.

Plaintiff's expert admits that when Defendant's forming rolls are spinning the fabric on the sides

of the core "beyond the tread portion", to which operation the Disclaimer limits the claims, the rolls are at *right angles* to the plane of the core (Vol. I, p. 73). This is represented in the following cut.



Since these forming rolls of Defendant operate at this angle "beyond the tread portion", it is plain that they do not and cannot "act * * * upon the centrifugally thrown out fabric", as required by the Disclaimer, for the reason that the fabric is inevitably thrown out by centrifugal force so as to be substantially at right angles to the plane of the core, and, therefore, *parallel* to the plane of Defendant's forming rolls. It is clear that, as the rolls and the thrown out fabric are parallel to each other, the operating edge of the rolls cannot act upon the thrown out fabric. Defendant's expert testified on this point as follows, with reference to the spinning rolls of Defendant's machine (Vol. I, p. 279):

> "there is no action directly upon the centrifugally held out fabric * * *. The action is, on the other hand, against the core, as in hand spinning."

Moreover, the forming rolls of Defendant's machine are forced against the fabric already stuck on the core by weights which exert an equal pres-

sure throughout the entire operation. This is an instance in which weights are *not* the equivalent of springs, because the weights exert an equal pressure for all sizes of cores and throughout the entire operation, while the pressure exerted by springs will vary for different sizes of cores and will grow less and less as the spinning rolls approach the inner, narrow portion of the core. This fact is not weakened because the State patent says that weights are the equivalent of springs, and that weights might be used (without describing how they could be used in the machine disclosed in the patent). Indeed, this statement was put in the patent by way of amendment seven months after the application was filed and was not supported by an oath (Vol. II, p. 369). *Steward* v. *American*, 215 U. S. 161. The fact that these two elements operate quite differently, in this environment, was admitted by Browne (Vol. I, pp. 63 and 64, Qs. 78-83). Generally springs and weights are equivalent, but there are a number of cases in which they are not. *Cross* v. *MacKinnon*, 11 F. R. 601. In order to be an equivalent, a device must be adapted to be used in the same environment for performing the same function in substantially the same way. *Burr* v. *Duryee*, 1 Wall. 531; *Superior* v. *August*, 273 F. R. 482 (C. C. A., 2); *Pittsburg* v. *Pittsburg*, 109 F. R. 644, 651 (C. C. A., 3). In Defendant's machine the spinning rolls *always* press against the fabric *which is adhering to the core* as distinguished from the outflying fabric, and they *always* exert the *same* pressure.

Therefore, not only has Plaintiff failed to carry the burden of proof which is upon it to establish infringement (*Price* v. *Kelly*, 154 U. S. 669; *Imhauser* v. *Buerk*, 101 U. S. 647; *Gray* v. *Grinberg*,

159 F. R. 138), by reason of the fact that Defendant's forming rolls are mounted differently and function differently from the description contained in the State patent and in the Disclaimer; but, and most importantly, there is non-infringement because the result of this arrangement in Defendant's machine is that the tires made on the alleged infringing machine do *not* have the radial stretch of the fabric skirts or edges, which is emphasized by Plaintiff as a characteristic of the State machine, and upon the presence of which, as a result of the action of centrifugal force, the Court below has based its decision.

The patent on Defendant's machine was put in evidence by Plaintiff, so that its statements can be used against him. It defines the *circumferential* stretch (Vol. II, p. 43, lines 41, 42) as "much greater than that possibly attained by the strongest operative". This puts the machine in what Plaintiff calls the single stretch class (*i. e.,* no radial stretch), since a strong operative can stretch 17 per cent (Vol. I, p. 197), and Plaintiff said in his brief below (p. 18) that a circumferential stretch of 17% or more signified the "single stretch" process. **Hence, the fact, as shown by this Record, is that the Defendant's machine which is charged to be an infringement, does not operate to produce this radial stretch which Browne says is characteristic of the State machine of the patent in suit and upon which he lays so much emphasis.**

To meet this situation, Plaintiff had his expert, Ray, visit the Lee factory, the Zee-Zee factory, the Ajax factory, and the Racine factory, which factories he said were employing machines made by

Defendant (Vol. I, p. 562, Qs. 105, 106). He says that he observed the operation of these machines and that he saw diamonds in the fabric in or near the bead portion with their long dimension radial (Vol. I, p. 566, Q. 122). He further says that he has purchased a tire made by each of these concerns from retail houses in New York and that he finds that there are diamonds present in the bead portions of these tires with their long axes radial (Vol. I, p. 567). This proof was objected to (Vol. I, pp. 563, 564, 567), and is clearly inadmissible. All this man did was to go to factories *six years after* the filing of the Bill of Complaint and say that he saw machines of the Defendant there which were so operated as to produce diamonds in the bead portion of the tires with their long axes radial. There is no evidence to show that these machines were like Defendant's exhibit machine,* or that they embodied the features alleged to be embodied in the claims in suit; or that they were made by Defendant prior to the filing of the Bill; or that the tires Ray purchased were made on said machines. Plaintiff's brief below (pp. 125, 128, 130, 131) placed great reliance on this testimony, and Judge Buffington seems to have accepted it for he said (Vol. II, p. 414) that Defendant's machine had "the loose edges, stretched by the centrifugal force induced by rapid core rotation". Defendant's machine has been in evidence and has been set up for inspection of Plaintiff's experts both in operation and out of operation, since a date prior to the taking of *prima facie* testimony. If these experts had wanted to test Waterman's statements that there was no radial stretch, all they had to do was to

* Ray admits that in all these machines the spinning rolls were operated manually, and not automatically as in the alleged infringing machine (Vol. I, p. 563).

make further examination of the exhibit machine in operation. But Plaintiff chose not to do this and, instead, followed a course which is illogical and of no evidentiary weight. This rearrangement of the fabric has been made by the Plaintiff and the Court below a necessary characteristic of the so-called "mode of operation" of the patent, so that a machine which did not produce this result would not infringe. The only fact evidence in this case as to the machine alleged to infringe is that it does *not* so operate.

In addition to the foregoing differences, it should be noted that Defendant's machine has no tread forming roll. The State patent repeatedly and clearly describes, as previously pointed out (*ante*, pp. 67-72), that the shaping of the fabric to the tread portion of the core is done by the "tread-forming-roll", and nothing else is suggested for this purpose. Now, before the spinning rollers can be employed to shape the skirts of the fabric to the sides of the core, as required by the claims, the fabric must have been previously shaped to the tread portion. Even Browne admits this, saying, Vol. I, p. 32:

> "However, before the skirts of the fabric can be shaped to the sides of the core the fabric must be first properly applied to the peripheral or tread portion of the core."

Hence, it is imperative that the tread forming roll shall be read into each of these claims. *McCarty* v. *Railroad*, 160 U. S. 110, 116; *Hawser* v. *Anton*, 233 F. R. 262, 264 (C. C. A., 6); *Rodman* v. *Deeds*, 261 F. R. 189, 192 (C. C. A., 7); *Thompson* v. *Union*, 86 F. R. 636, 637 (C. C. A., 2); *Jewell* v. *Jackson*, 140 F. R. 340, 344 (C. C. A., 8); *Herman* v. *Youngstown*, 191 F. R. 579, 583, bottom of

page (C. C. A., 6); *National* v. *Wheeler*, 79 F. R. 432, 438, 439 (C. C. A., 2).

As the Defendant's machine does not have any tread forming roll or any equivalent therefor, we submit that it clearly does not infringe.

Again, the patent plainly describes as an essential, a construction whereby a *pair* of rolls of fabric are arranged to be alternately moved into juxtaposition with respect to the core for supplying the fabric thereto. On page 1, beginning at line 27, the patent says:

> "My machine comprises a power-driven ring-core in connection with a *pair* of stock rollers which have wound thereon strips of canvas skim-coated with rubber and cut on the bias." (Italics ours.)

and beginning on line 45 the patent again says:

> "This combination in an open tire-shoe making machine of a power-driven ring-core with a *pair* of stock-rolls from which alternate layers of crossed fabric may be supplied to the ring-core *is an important feature of my invention.*" (Italics ours.)

The patentee describes and illustrates other arrangements of *pairs* of stock rolls to be alternately brought into operative position with respect to the core (p. 3, lines 42-53; Figs. 13 and 14); but he always insists upon the employment of a pair of stock rolls to be alternately brought into position, and never suggests that his machine could be operated with a single stock roll. Without a source of fabric supply including a *pair* of stock rolls, as described, there is no means, in the State patent, for getting the fabric onto the core. Therefore,

this element must be read into the claims in order to make them operative. See cases cited *ante,* page 155.

Defendant's machine uses a *single* stock roll 67 (see Fig. 1, Vol. II, p. 26); and obtains the crossing of the threads of the fabric by so constructing and arranging the machine that the core can be rotated in opposite directions, so as to draw the fabric from the stock roll first one way and then another (Vol. II, p. 40, line 55, etc.; p. 43, lines 92-117). Browne admitted this on cross-examination (Vol. I, p. 78, x-Qs. 151, 152), and also admitted that the State patent has no "arrangement for operating in this matter" (*id.*).

Of course, the omission of a single element which is in the claims as written or by necessary construction, defeats the charge of infringement (*Cimiotti* v. *American,* 198 U. S. 399; *Eames* v. *Godfrey,* 68 U. S. 78); and, as Defendant's machine is not only constructed differently but operates differently, there is, in the case at bar, no infringement.

Conclusion.

Long ago this Court said in the celebrated case of *Rubber Co.* v. *Goodyear,* 76 U. S. 796:

> "A machine may be new, and the product or manufacture proceeding from it may be old, in that case the former would be patentable, and the latter not. The machine may be substantially old, and the product new. In that event, the latter, and not the former, would be patentable. Both may be new, or both may be old. In the former case, both would be patentable. In the latter neither. The same re-

> mark applies to processes and their results. Patentability may exist as to either, neither, or both, according to the fact of novelty, or the opposite. The patentability or the issuing a patent as to one *in no wise affects the rights of the inventor or discoverer in respect to the other. They are wholly disconnected and independent facts.* Such is the sound and necessary construction of the statute." (Italics ours.)

In the present case it is demonstrated that the machine of the State patent is old. This is shown in the Belgian patent alone, and is admitted by the Disclaimer. The tire, which is the product of the machine, is also old, as is admitted by Plaintiff and found by the Court below. The process or method alleged to be followed by the machine of the State patent is established to be old, by overwhelming proof, in hand operation, not to speak of the Belgian patent, Moore patent, and Seiberling & Stevens patent. This has been so held by the unanimous decision of the Court of Appeals for the Sixth Circuit, by the District Court of New Jersey, and by one member of the Court below. The only point, therefore, upon which the decision of the majority below hangs, is the repeated assertion that the patent in suit discloses a *process* whereby *centrifugal force* generated by high speed rotation of the core causes the fabric to *stretch itself radially.* This point is not suggested in the patent in suit or in any testimony in the record, has not been advocated by Plaintiff's counsel, and is contrary to established laws of physics.

The Disclaimer is unlawful and voids the patent

The patent was the joint invention of State and others, and is void.

Defendant does not infringe.

Therefore, we submit that the decision of the Court of Appeals for the Sixth Circuit and of the District Court of New Jersey should be approved, and that the majority decision of the Circuit Court of Appeals for the Third Circuit should be reversed.

Respectfully,

LIVINGSTON GIFFORD,
E. CLARKSON SEWARD,
THOMAS G. HAIGHT,
Counsel for Petitioner.

APPENDIX.

Opinion of the Court of Appeals for the Sixth Circuit.

No. 2954

UNITED STATES CIRCUIT COURT OF APPEALS.

SIXTH CIRCUIT.

THE FIRESTONE TIRE & RUBBER COMPANY,
Defendant and Appellant,

vs.

FRANK A. SEIBERLING,
Plaintiff and Appellee.

Argued March 14, 1917.
Reargued April 8, 1918.
Decided December 13, 1918.

Before WARRINGTON, KNAPPEN and DENISON, Circuit Judges.

DENISON, Circuit Judge: Seiberling brought the usual infringement suit against the appellant, based upon two patents, each relating to the manufacture of casings for automobile tires. The first was issued to Seiberling and Stevens on June 14, 1904, and was No. 762,561; the second was issued to Seiberling on November 30, 1909, No. 941,962, upon an appli-

cation made by State. The court below held valid and infringed claims 1, 2 and 14 of the earlier patent, and 16 claims of the later patent. The defendant had denied that there was either validity or infringement. After the case had been argued in this court, the defendant discovered a Belgian patent (Mathern, of September 20, 1906) said to show anticipation of State as to some features involved; and, upon an application to remand the case for further proofs, a stipulation was finally made and approved by the court by which this patent and explanatory affidavits were incorporated into the record. The case was then again argued. The record and proofs are unusually voluminous, but, in view of the conclusions which we reach, a relatively brief statement will be sufficient.

A tire casing of the class now involved is composed of successive layers of fabric, cemented together by a suitable composition and shaped into the form of a tube, which is open on one side so that it is horseshoe-like in cross-section, and the ends of which are joined together to make it circular and endless. The tube opening or slot is along the inside; and a solid rubber body is added along the outer circumference or periphery to constitute the tread portion of the finished casing. The general process of manufacture by hand, much older than the Seiberling and Stevens patent, was this: An annular metallic core having spokes and a hub was centrally mounted upon a shaft so that it could revolve, the core thus resembling the rim or tire of a wheel. This core was approximately circular in cross-section, and its cross-section diameter as well as its entire diameter through the hub from edge to edge of the rim were proportioned according to the size of the casing to be made. The operator coated this core with an adhesive sub-

stance. He then took a strip of rubber-impregnated fabric which would stretch out to be as long as the circumference of the core, and in width somewhat less than the circumference of the cross-section. As he revolved the core on its hub, he stretched and pasted this fabric strip upon the core, pressing and shaping it with his fingers or with hand tools so that it adhered in all places and was without wrinkles. He repeated this operation as many times as there were to be fabric layers in the casing. The impregnating composition, having the character of rubber, would also attach each two layers of the fabric together. The strip of fabric was cut upon the bias, and the warp threads therefore ran from the inner open edge of the tube in a diagonal course along, across and around the tube to the other open edge thereof; and the next layer of fabric put on was reversed so that these warp threads crossed those of the first layer at a selected angle. Where the ends of the fabric met each other, they were overlapped enough to make a pasted joint. Each layer of fabric was first pressed down and attached by the hand of the operator on its central portion throughout its length, thus constituting the part of the casing corresponding to the tread. The degree of lateral curvature here is slight, and there would be no difficulty in making a smooth attachment, but as it was continued around the remaining circumference of the cross-section, there would be an obvious tendency to gather and wrinkle. This wrinkling would be fatal to the strength of the casing, and it could be avoided only by careful manipulation and gradual shaping. The ultimately smooth and unwrinkled surface could be had by virtue of a quality which all woven material has had since weaving was known, *i. e.*, that it will contract in one direction as it stretches in another. When

a fabric is stretched in one diagonal direction, its square meshes become diamond-shaped, with the length of the diamond along the line of stretch and its width at right-angles. This produces a contraction of the fabric in the line of its width. In tire building, it is primarily the central part of the strip which is thus stretched longitudinally as it is attached to the tread of the core, leaving the side portions or wings projecting and free. Upon the same principle, if these side portions are then stretched laterally, they will shrink longitudinally, and, if this stretching is done in progressive measure as the edges are approached, the longitudinal shrinking will be greatest at the edge. In this way, it results that the fabric may be shaped smoothly and without wrinkles to the entire side core surface.

The Seiberling and Stevens patent seems to disclose a machine for doing this work automatically, instead of manually. The machine comprised (so far as now necessary to mention): first, a main power driven shaft which would indirectly engage and drive the core and with such selective connections that the core could be revolved at low speed or at high speed, or entirely released, as desired; second, a reel carrying the rubber-impregnated fabric strip; third, a tension roller retarding the reel, and thus causing the central tread strip of the fabric to be given a continuing stretch after the free end is attached to the core; fourth, a pressure roller or cylinder concaved on its exterior to match the shape of the tread of the core, whereby the tread portion of the strip was pressed upon and attached to the core as the latter revolved; fifth, an arm carrying, at its end, a laterally spring-pressed finger—"the jigger finger", and which arm was intended to be reciprocated rapidly, radially of the core, in such a way that the finger traveled in and

out radially, pressing against the side of the core as the latter revolved, and which pressure finger therefore traveled a saw-tooth course between the edge of the stretched, central, tread portion of the fabric and its final outer edge, and corresponded in function to the human finger pressing the fabric down against the core and stretching it into shape; sixth, a further arm containing a further pressure wheel to be applied along the edge of the attached fabric, after it was attached, to press it into a crease, constituting "stitching". The described operation is consistent with the idea that the side pressure-attaching finger would follow immediately the tread pressure roller, so that with one revolution of the core the machine would attach the fabric, press down the tread and press in the sides, and so that all of these devices would be in operation at the same time on the same strip. After one complete revolution, the core was stopped and the fabric cut away from the reel strip. If the one revolution had not been sufficient, then, after the fabric was cut away and the loose end pasted down, as many more turns could be had as necessary,—apparently with all the attaching means at work together,—if desired. Based upon the disclosure thus generally described, the patentees claimed:

> 1. "The combination in a machine of the class specified of a tension device to simultaneously smooth and flatten strips of fabric, a revoluble core to receive said strips from said device, means to form said strips approximately longitudinally about said core and means to regulate the tension on said feeding device."
>
> 2. "A machine of the class specified consisting of revoluble means to support the article

to be built while in the process of manufacture and means for creasing or stitching portions of said article on said revoluble means."

14. (The fourteenth claim does not differ from the second in any respect now material.)

The second and fourteenth claims must be held invalid for the same reasons pointed out with regard to claim 4 of the State patent, later discussed. The creasing rollers are hung on a swinging arm which happens to be attached to the frame of the machine. It might as well be fastened to the ceiling of the room. The pressure applied to the creasing rollers, which forces the fabric into the creases, is the pressure of the operator's hand. They are not at any time or to any extent operated by the mechanism which operates the other parts of the machine. They are "only used at intervals". There is no combination between these creasing rollers with their supporting arm and the other parts named in the claim. Their mutual relation is precisely that of the writing lead and the erasing rubber in the rubber-tipped pencil, where the only connecting link is the carrier. It may further be observed that claim 2 is not limited to a machine handling flat strips of fabric, unless by the phrase "in a machine of the class specified". This phrase, as found in other claims,—*e. g.*, 3,—shows no intent to effect such limitation. If the claim covers devices which receive and treat strips of fabric prewoven to form,—as it seems to,—it is anticipated by Johnston, Jeffrey or Moore.

We do not thus dispose of claim one. We are not prepared to say that it is anticipated or that there is no combination between its elements when they are treated as the specification indicates. The tread-pressure roller automatically effects the revo-

lution of the core. With it, the reel and the tension device may be in simultaneous operation. The side pressure fingers are reciprocated by tripping in a connection with the main driving mechanism, and may be operated simultaneously with the other just named parts,—at least, for part of their work. It is not necessarily fatal to the theory of combination that continuing the work of the pressure fingers may be necessary after the tension device has exhausted its function. Without intending to pass upon all the questions involved, we prefer to assume the validity of this claim and look to see if there is infringement.

The defendant's device is particularly described hereafter. It is enough now to say that it has no tread-forming roller which operates simultaneously with and in advance of the side-forming means, and that it has discarded the jigger finger, operated by the driving power of the machine, and has substituted side-pressing means of different form and operation.

Whether defendant's instrumentalities are equivalent to those of the Seiberling and Stevens patent, under any scope which the state of the art permits to the phrase "means to form said strips longitudinally along said core", is a question which we find unnecessary to decide. Another reason sufficiently requires the conclusion that claim one is not infringed. Out of the four elements named in the claim, the first is, "a tension device" which feeds fabric strips to the core, and the fourth is, "means to regulate the tension of said feeding device". In a certain sense, every tension device is, in itself, a means for regulating, and it is not impossible that, under some conditions, a tension device by itself might be held sufficiently responsive to the descrip-

tive words of both the first and the fourth elements; but this second claim must be construed to require the independent existence of the fourth element in order to make out infringement. This is the apparent force of the face of the claim. The specification carefully describes regulating means by which the tension resistance can be instantly varied at the pleasure of the operator, by turning an adjusting screw. The present first claim is a substitute for the first three claims as filed. At the time of filing, claims 1 and 3 contained no reference either to tension device or regulating means, while claim 2 did not mention a tension device separately from its included "means to adjust the tension on the feeding means". After a rejection, claim 3 was amended by inserting a reference to the tension device itself. After a further rejection, the three claims were cancelled and the present one substituted. It was then allowed. The applicant had presented one claim referring independently to the tension device and one claim referring independently to the means for adjusting the tension. With this in his mind, he withdrew them and presented and secured a claim calling for each of these elements as separately existing. The intent to regard the ability to modify the tension device as an essential part of the invention which was being patented, could not well be clearer. It seems now to have developed that this adjustability is not very important, in the commercial use of the machine; but these patentees then might well have believed that it was vital to an operative machine. They had in their minds a friction tension, and they saw that the amount of stretch to be given to the fabric by it would depend upon the length of the fabric strip under stretch, the width of the strip, the strength and other inherent qualities of the fabric, the extent and mois-

ture contents of the rubber impregnation and very likely the temperature and humidity of the air in the factory. All these conditions might change from hour to hour. Hence, the independent and separate call for regulating means can not be considered a mere inadvertence, the limiting effect of which a court would be inclined to escape, if possible. Although it may be voluntary and unnecessary, it must be given effect. (*McLain* v. *Ortmayer*, 141 U. S. 419, 425; *Arnold-Creager Co.* v. *Barkwill Co.* —C. C. A. 6—246 Fed. 441, 444.)

Defendant uses a different tension device. There is no efficient frictional resistance to the travel of the fabric to the machine, but the resistance is caused by a positive gear connection. The periphery of the fabric feed roller is compelled to travel at a speed proportionate to the peripheral speed of the core, and at a fixed percentage less. This percentage is determined when the machine is built, by providing, for the feed roller and for an intermediate roller peripherally driven by the core, intermeshing gears of the same number of teeth, and by making the feed roller of smaller diameter than the intermediate roller. After the amount of stretch is thus determined and fixed,—at, say, fourteen per cent., —it can never be varied,—unless by an expedient which plaintiff suggests and upon which theory alone he seems finally to rely to make out infringement of this claim. It is said that, by substituting upon the feed roller another gear with a greater or less number of teeth the speed of the feed roller can be increased or diminished. This is true; and it may well be that if the defendant's machine were built in contemplation of such a change, and if an assortment of gears were provided with it therefor, it should be thought to contain "means to regulate the tension"; but there is nothing to indicate that

the machine was built with any such purpose, or that the defendant has any means of thus regulating the tension, or ever has done so or desired to do so. In this situation, it seems an apt suggestion by defendant's counsel that we might as well say an ordinary table contains "means for regulating" its height, because we can take off the legs and put on some longer ones.

The theory that the constant stretch insured by defendant's mechanism constitutes both a tension device and a means for regulating it is urged by plaintiff's counsel, when they say that "to regulate" means "to maintain". To adopt this theory is to say that the phrase "means to regulate, etc.", adds nothing to the claim. We can not conceive any tension device which is not, in itself, "means to maintain" a fixed tension. Further, the theory would be, obviously, untenable, unless the patent were entitled to the most extreme liberality because it produced very great practical commercial results. It can not have such a degree of credit. If the machine in the patented form had proved successful, and had gone into extensive or even considerable use, it might be regarded in this light, even though it had not been generally accepted until aided by later patented improvements. This did not happen. One machine was built, but there is evidence that no tires were successfully made upon it, and that the jigger fingers would not smooth the sides so as to make first-class tires. Certainly, its attempted use by the Goodyear Company was abandoned, the machine discarded, and no other ever built.

We further find that upon the application for the State patent Mr. Seiberling, familiar with everything which had been done on the Seiberling and Stevens machine, made an affidavit that State's ma-

chine "was the first to successfully make such tires on a commercial scale by machinery." This affidavit does not work any estoppel, but there is every reason why we should accept it as true in its necessarily implied reference to the Seiberling and Stevens machine, and decline to give that patent the breadth of construction, beyond its letter, which is appropriate only for a great practical success.

Whether defendant employs any tension device "to simultaneously smooth and flatten strips of fabric", interposing, as it does, nothing between the feed roll and the means which throw the fabric out of flat, may be passed without consideration. For the reasons stated, it must be held that there is no infringement of claim 1.

The Seiberling and Stevens patent belonged to, or was practically under the control of, the Goodyear Company, one of the largest manufacturers of tires, and of which Mr. Seiberling was general manager. State was in the employment of the same company. After about five years, State filed his application for the second patent in suit. His machine was developed and his patent application prosecuted under the supervision of Mr. Seiberling. *State's machine was of the same general type as Seiberling and Stevens.* His most substantial change or improvement was that he discarded the reciprocal in-and-out forming-finger of Seiberling and Stevens and substituted a tool which he rightly calls a spinning roll. He provides, in the same general way, a core and a fabric reel and a retarding device, whereby he gets his strip of fabric attached to the core for the width of the tread portion, leaving the remaining wing portions projecting outwardly. Attached to the base of the frame which carried the revolving core was a standard,

manually adjustable horizontally to and from the core; that is to say, it traveled in a horizontal track, which track was an integral part of the frame. At the upper end of this standard was a revolving head or table, called, by State, a turret, and so plainly the turret of the common turret lathe that his choice of name was most natural. Mounted at four equi-distant points on the edge of this table are four tools, independent of each other except for their common base. The first carries the tread roller, the second the spinning rolls, the third the stitching rolls, and the fourth the bead attaching rolls. The turret standard was fixed in the plane of the revolving core, beyond the periphery thereof, and State revolved his turret until the tread roller was in the same plane, with its axis at right-angles thereto. He then moved the standard and turret forward so that the tread roller bore against the tread on the core, with such pressure as the operator chose to give it. When the tread was sufficiently smoothed down and attached, he moved the standard back, gave the turret a one-fourth revolution, bringing the spinning roll device to bear and moved that forward in the plane of the core until the operation of spinning down the side was complete. He then withdrew the standard, gave the turret another one-fourth revolution, and, in the same way, moved it forward again and used his creasing or stitching roll, if necessary. Then, again, by a similar operation, he brought into effect the fourth device on his turret, which was a bead-forming or trimming roll, to be used in certain cases only. In each instance, the time during which and the pressure with which the tool was to be applied (except for certain spring pressure) was regulated by the operator's hand. In no instance did the machine do anything except to keep the core re-

volving. The fact that the tools were mounted on a revolving table, which table was mounted on the frame of the machine, cannot be important. From the standpoint of an interdependent combination, the situation is the same as if these four tools had been lying upon a work-bench by the side of the operator and he had successively selected the ones he desired. While this is obvious, it is emphasized by the fact, clearly appearing, that operators using the State machine often discard the spinning tool mounted on the turret, and, after the tread is formed, spin the sides down by hand.

In the form of spinning tool shown in the patent, there are two rolls pressed toward each other by springs and operating upon both sides of the tire at the same time. There is, thus, an automatic feature to the pressure with which the spinning rolls are applied; but this does not show the existence of any combination with the remainder of the machine. A hand tool with two oppositely spring-pressed rolls would work in the same way if it were hung from any support, or held only by the workman; and there is no relation of dependency between the automatic action of the springs and the automatic action of the revolving core. They both affect the material at the same time, and that is the most that can be said. The fabric reel and the tension device have finished their function when the first revolution is completed and when the strip of fabric has passed once around the core and has been cut and the pasted-on joint made. They have no further office in the building of the tire than if they did not exist. The tread-forming roller then is brought into play and finishes its function and drops out of action. Then, and only then, the operator brings the spinning roll to bear. It performs its work precisely as it would if the fabric strip

had been stretched and attached wholly by hand; and the sides of the tire, the tread of which has been formed by the aid of the machine, may be spun down and attached by hand operation just as they are by State's device. We do not intend to deny that a true combination may sometimes be found where the same underlying mechanism operates all parts of the machine and where different elements separately act in successive steps upon the raw material as it is being transformed into the ultimate product (though the latest decision of the Supreme Court,—*Grinnell Co.* v. *Johnson Co.*, 247 U. S. 426, perhaps tends to the contrary); but the trouble here is more vital. State's spinning tool has no operating connection whatever with the remainder of the mechanism. Each part performs its own work in its own way, and no new result flows from bringing the two into juxtaposition. We may find further illustration in the familiar turning lathe. If the cutting tool is carried in a holder which automatically travels along a line parallel to the axis of the revolving chucks which hold the material being shaped, we can see the combination between the chucks and the cutting tool; but not so, if the tool-holder is moved along its path by the operator's hand,—even though the path be upon a fixed guide.

In *Gas Co.* v. *United Co.*, 228 Fed. 684, we considered the distinctions between aggregation and combination. Applying to the present case the principles there developed and the authorities there cited, we are satisfied that there is no true combination between State's revolving core and his independent spinning tool, or between such core and his independent tread-forming roller, or between such roller and such spinning tool. The *Grinnell* case, *supra*, may involve the difference between that put-

ting of old elements into a co-acting relationship which is invention as distinguished from a similar putting together which is merely skill, rather than involve the distinction between elements which form a composite as distinguished from an aggregate; but, however that may be, that decision fortifies the result which we reach here. It is not easy to see any difference in principle between a device which first washes a garment, and then, by separate mechanism, dries it, and a device which first shapes and attaches the tread of the tire, and then, by separate mechanism, attaches the sides.

This conclusion invalidates, because of mere aggregation, claim 4[1] and all the other claims of the State patent sued upon (except the fifteenth, seventeenth, and perhaps the eleventh). We might safely rest our decision thereon; but *plaintiff really presents his case on the theory that State discovered a new method of making tire casings* or a new set of functions to be performed by associated mechanism. Although a mechanical patent may not be granted for a function (*Westinghouse* v. *Boyden Co.*, 170 U. S. 537), yet it is now settled that a method patent may be granted for an association of successive mechanical steps (*Expanded Metal Co.* v. *Bradford*, 214 U. S. 366), and to hold a mechanical patent void for aggregation, when the same monopoly sought by the patent might have been obtained through a method patent, seems somewhat artificial; hence, *we prefer to point out also that State had nothing broadly new either in his method or in his selected tools;* and that so far

[1]Claim 4. An open tire-shoe making machine, comprising the combination of a sheet-fabric supply, a power driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support, for passing radially along the sides of the tire-shoe, to shape the sheeted fabric on the core, substantially as described.

as some details may be new, they are not used by defendant.

The art of shaping a flexible sheet of metal over irregular forms or dies, circular in cross-section, was very old and was known as "spinning". This was done by clamping the metal sheet upon the form, revolving both together rapidly upon the axis of the circular cross-section, and then with a tool, —which might be a narrow or sharp-edged roller or disc held in a yoked handle,—pressing the metal down against the form. The spinning disc, being held in a plane substantially tangential to the circumference of the form at the point of contact, would itself be caused to revolve; and, if it were slightly inclined inwardly from this tangential plane, it would gradually move down along the side of the form and its path thereon and upon the metal would be helical. The successive coils of this travel might be so close together that they practically touched each other, and so the whole surface of the sheet and of the form would be covered by this travel and the sheet would be stretched and shaped to the form. If State had been the first to observe that this spinning process could be applied to shape a tire upon its core as well as to shape a bottle cap upon its core, the question of whether there was invention in the transfer would have required consideration; but he was not. *The evidence that this identical spinning operation was performed upon tire casings by hand tools before State's invention is sufficiently satisfying to meet all the requirements of the situation.*

One witness testified that this spinning operation with a hand tool was common practice for smoothing down the sides of tires at a date three years earlier than the building of the first State machine; one told of the same practice in use at

Detroit the same year State was constructing at Akron; and one seems to refer to it as a common practice in the Goodyear shop in 1903. Considered critically, all this testimony might not be sufficiently definite and positive to prevail by itself against circumstances tending to throw doubt upon it; but there are no such circumstances. When defendant's proofs closed, this proposition would ordinarily be taken as fairly established; *Messrs. State and Seiberling were called as witnesses on the rebuttal; both were familiar with the history of the art; neither one denied or questioned this proposition; nor did any other witness for plaintiff. More than this, State, in his specification, speaks of this spinning operation as if it were well-known hand practice, and seems to rely upon the advantages of his tool over the existing hand method. This is not all: the Seiberling and Stevens patent shows what it calls creasing or stitching rollers. Each one is undoubtedly an effective spinning tool and capable of use as such;* their edges, as shown, may be sharp enough to cause some danger of cutting the fabric, but the spinning would be done by the side bevels, not by the extreme edge; and plaintiff's theory that defendant's spinning roll is so far the equivalent of the Seiberling and Stevens stitching rolls as to make out infringement of the claim based thereon goes far to persuade that they are, in a broad sense, an anticipation of State's spinning roll. *There seems no sufficient reason to doubt that Stevens used them for spinning in 1903 or 1904. The Moore patent shows what is, essentially, a spinning roll for operating against a revolving core in making a tire casing.* It was intended to and did smooth down the Moore tire from the center of the tread only part way, and not much further than may be done

by the typical tread-forming roll; but the operation is substantially spinning, as far as it goes, and involves, in some degree, the characteristic relocation of the threads of the fabric, even though it may only put them back where they were before the casing was distorted by placing it on the core. In the Moore patent, the handle of the spinning roll was so attached to its frame that the roller could not effectively travel radially of its core down as far as the bead, but if its attaching staple is made larger, the whole tire can be formed thereby, as demonstrated. *Further, there is no reason to doubt that State and Seiberling were familiar with the character of patent protection, and were advised by competent counsel. If they had thought that State was the first to shape the sides of the tire by the spinning operation, it is highly improbable that he would have omitted to apply for a method patent.* Still further,—it is conceded that the Belgian patent is a complete anticipation of State as to the matter of employing a radially-moving spinning roll in this type of tire-making machine for shaping the side of the tire,—unless plaintiff is right in his contention that in the Belgian patent the fabric was first partially attached to the side by a device resembling Seiberling and Stevens' jigger fingers, that this operation left wrinkles and puckers, and that the spinning roll was used only to remove these wrinkles and perfect the attachment. We do not see that this alleged distinction is very important. *No matter if the fabric has been already partially attached,—as much as is consistent with any reasonable theory of operation,—the tool of the Belgian patent is a spinning roll, and performs a spinning operation; and, if we are right in what we subsequently say regarding the "centrifugal force" theory, the Belgian tool in its*

radial progress was bound to stretch and reshape the fabric in substantially the same way that is done by State. Putting all these things together, *State can not be considered as the inventor of the method;* and hence there is no reason to hesitate at the result reached because of aggregation.

One group of State's claims is distinguished by the call for shifting the revolution of the core from a slow speed while the fabric strip is being put on to a high speed while the spinning is to be done. Seiberling and Stevens did the same thing, so far as concerns any broad idea, and the particular devices by which alone State distinguishes this part of his action from Seiberling and Stevens are not employed by defendant.

Another group of claims is characterized by the requirement that the spinning roller should be set in a plane at "a receding angle" to the plane of the core. It is not clear that this thought imparts any novelty to the claims. The same angle is shown by the Seiberling and Stevens stitching rollers, and it was certainly open to the user of any hand tool to apply it in this specified plane. However, the defendant does not do this; the claim of infringement in this is based upon a confusion of thought. If we picture the spinning roller as a disc,—whereby its plane is more sharply conceived,—and if we assume that the core is vertical and its axis horizontal, and that the disc is to be applied to the core midway from top to bottom, we observe that the plane of the core and the vertical plane of the axis are at right-angles to each other, and that the relationship of the plane of the spinning roll to the plane of the core, and its relationship to the plane of the axis, are independent of each other. The plane of the spinning roll may be at right-angles to the plane of the core and at the same time at any selected

angle to the plane of the axis. So far as concerns the first relationship above stated, defendant's spinning roll is normally set with its axis horizontal and parallel with the core plane, and therefore operates in a plane at right-angles to the plane of the core; but it is capable of adjustment to, and is intended sometimes to operate in, a plane not at a receding angle to the plane of the core, but at an angle which, as compared with that shown by State, is more than ninety degrees,—an advancing angle. In other words, its carrying yoke, normally at a right-angle to the core plane, may be swung slightly on its pivot toward the outside of the core. The only purpose and utility indicated by State for his receding angle are that the disc may not become entangled with the out-flying skirts of the fabric, and the angles adopted by defendant, for normal use or for special setting, tend to produce the very result shunned by State. In the machines used by defendant the spinning roll may be manually placed at the "receding angle", but in operation it will not stay there, but returns at once to the right-angle position. Defendant did at one time make some use of a machine embodying this "receding angle", but it was not practically more than experimental and has been abandoned, and was too negligible to justify any judicial action based thereon. The defendant does set its disc at an angle, which may be called "receding", to the vertical plane of the core axis; the disc axis (in the form assumed) ceases to be horizontal, being shifted perhaps ten degrees; but this is a different matter. This setting is for a purpose different, and causes a result different from anything found in State. It brings a constant radial slip or wipe of the roller upon the fabric, and directly causes a radial stretch. The claims of this group are not infringed.

If the "forming roll" of claim 11 is the spinning roll, the claim is invalid for aggregation; if this "forming roll" is the tread roller, then the claim is anticipated by the Seiberling and Stevens machine.

Claim 15 suggests nothing new over Seiberling and Stevens, excepting a yieldingly mounted take-up roll for receiving a layer of muslin, or thin cloth, which is upon one face of the rubber-impregnated fabric as it is rolled upon the supply reel. Precisely the same take-up roll is shown in older machines for feeding similar rubber-impregnated fabric to make rubber belting. It can not be important that the fabric in this case is received by a revolving core, rather than by the receiving mechanism of the old machines. The take-up roll does its old work in its old position and for its old purpose. Its transfer from the old machines to Seiberling and Stevens discloses no inventive novelty. Claim 17 also reads upon Seiberling and Stevens, save for the addition of "a stretching roller between the tension device and ring core whereby the longitudinal creases are taken out of the fabric and it is smoothly and evenly supplied to the ring core". This also discloses the adoption of a device in common use for the same purpose in analogous situations; but its declared purpose and effect are to avoid the very operation which defendant employs. This stretching roller is for the purpose of delivering the fabric to and upon the ring core in a smooth and flat state. Defendant interposes a convex shoe which delivers the fabric strip to the core in a curved or U shape. The curved shoe or form which gets the latter result could not be considered the equivalent of the flat rollers which get the former without a much greater degree of liberality than is,—at the best,—permitted by the state of the art.

Claim 14 is not sufficiently typical to justify using it as the criterion of infringement, as plaintiff would have us do; but, if it were, it shows still another reason why plaintiff must fail. It calls for a stock roll, a ring core, "a radially and transversely movable support, a tread forming roll and a laterally yielding spinning roll for passing radially over the sides of the tire shoe mounted thereon", etc. The tire shoe is not mounted on the spinning roll; the clause "for passing * * * tire shoe" is parenthetically descriptive, and the claim must be considered as specifying a radially and transversely movable support having mounted thereon a tread roll and a spinning roll. Defendant has no one support carrying these two rolls, but has two independent supports. One is movable radially, neither tranvsersely. The claim plainly refers to the revolving turret, when it says "support", and defendant has nothing equivalent.

The argument for plaintiff takes the Seiberling and Stevens invention of 1903 and the State improvements of 1908 and puts them together as constituting one pioneer patent dated in 1903; or, stated in another way, it takes the large public acceptance and use of the State patent and thereby attributes merit to the Seiberling and Stevens patent, overlooking the undoubted fact that *the first reasonably successful commercial machine was that of Vincent*, who intervened between the two. It goes without saying, that the Seiberling and Stevens patent is just as effective in denying to State the position of pioneer as if it had not happened that both have been controlled by the same interests.

We are told that the centrifugal force disclosed by State's operation caused the unattached skirts of the fabric to fly out at right-angles to the plane

of the core, and that the effect of the spinning tool slowly advancing against this skirt was to produce a "hinging and folding action" which was novel and important. We are not impressed by this claim. These words do not seem very appropriately descriptive, but *the action which takes place not only pertains to a method or process rather than to any particular mechanism, but it was more or less inherent in the rapid revolution of the core effected by older means, and in the use of any spinning, stitching or creasing rollers.* It is not the "hinging and folding" but the radial stretching, and the resulting circumferential contraction, that bring about the desired smoothness. It is possible that in State's particular form of device, with his spinning disc at its "receding angle", and practically tangential to the core circumference at the point of contact, there will be enough "hinging and folding" back over his tool to produce a friction which would cause more stretch than could the mere rolling advance of the disc in its helical path; but if there is an appreciable effect of this kind, defendant does not have it. Defendant gets its stretch from the slip or wipe which is compelled by the fact that the spinning disc can not roll unobstructedly in its own plane,—which fact results from its inclination toward the plane of the core axis. This very inclination puts part of the disc out beyond the supposed line of "hinging and folding", and prevents a fold at the point of contact. *Centrifugal force is not mentioned, in State's specification, save as creating an obstacle to be avoided. Perfectly successful spinning performed in court, upon a slowly revolving core, demonstrates that the outflying skirts are not essential. To make centrifugal force an effective basis of validity in the State's patent would be to give a monopoly of the*

spinning process or of rapid core rotation; and each was old.

We are also told,—and upon this plaintiff seems to place great reliance,—that Seiberling and Stevens or State,—we are not sure which, but apparently by some kind of joint action,—discovered and accomplished for the first time such a distortion of the fabric meshes as gave great strength to the built-up casing. This result plaintiff's counsel denominates "the rearrangement of the reticulations" and "placing the threads in geodetic lines". There was nothing new about this. On the contrary, it had been present in every smooth fabric tire casing that had ever been made by anybody. As we pointed out in the early part of this opinion, it is inherent in shaping a fabric to an irregular surface. It consists in the fact that when the rectangular mesh is expanded on one diagonal axis it will contract upon the other. Outside of tire casings themselves, a familiar instance is the shaping of canvas to cover the hull of a canoe. Still more familiar is the handkerchief or the collar, unevenly ironed. This discovery by plaintiff or his counsel was in the realm of nomenclature, not of mechanics.

The decree must be reversed, and the record remanded with instructions to dismiss the bill.

JAN 14 1924
WM. R. STANSBURY

IN THE

Supreme Court of the United States.

No. 185. OCTOBER TERM, 1923.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

vs.

FRANK A. SEIBERLING,
Respondent.

BRIEF FOR RESPONDENT.

MELVILLE CHURCH,
LUTHER E. MORRISON,
Counsel for Respondent.

The Stratton Post Job Printing Office, Inc., 154 Fulton St., New York, N. Y.

INDEX.

	PAGE
Statement of the Case	1
Decision of the Court of Appeals for the Sixth Circuit	2
Prior Tires	3
Automobile Tires	3
Re-Arrangement of Fabric Reticulations	6
Double Stretch Hand Practice	8
Single Stretch Method	11
Advantages of Double Stretch Method	12
The Seiberling & Stevens Machine	14
Third Circuit Court of Appeals	15
Sixth Circuit Court of Appeals	15
The Vincent Machine	15
The Two Prior Machines of Seiberling & Stevens and Vincent	17
Hand Spinning	17
Sixth Circuit Court of Appeals	17
Hand Spinning Forbidden	19
Great Skill Required for Hand Spinning	24
Large Circumferential Stretch and Corresponding Absence of Radial Stretch in Hand Spinning	25
Hand Spinning not Applicable to Large Tires.	27
Core Speed Irregular in Hand Spinning	30
Core Speed Too Low in Hand Spinning	32
Roll Pressure Irregular in Hand Spinning	35
Other Defects of Hand Spinning	37
Tire Quality Poor with Hand Spinning	38
The Court of Appeals for the Third Circuit on Hand Spinning	39
Unsuccessful Attempt to Embody Spinning in a Machine	40
The Development of the State Machine	41
Third Circuit Court of Appeals	41
State's Deposition	44
1st Device	45

PAGE

2nd Device 46
3rd Device 46
4th Device 47
5th Device 47
6th Device 47
Sketch 7 48
Sketch 7*a* 48
Sketch 7*b* 49
Sketch 8 49
Sketch 9 50
Sketch 10 50
Sketch 11 51
Sketch 12 51
Sketch 13 52
Sketch 14 52
Sketch 15 53
Other Difficulties 53
Double Stretch 54
State's Assistants 54
State's Dates 56
State's Work Completed 57
First Commercial Machine 57
Original Commercial Speed 59
Alleged Defects in Rolls 61
Commercial Success 62
The Improved Product 65
Preparing the Tires 67
The Actual Test 70
Hand Spun Tires do not Embody Double Stretch 71
Converting Hand Method into Machine 72
Third Circuit Court of Appeals 75
Penn *vs.* Conroy Distinguished 76
The State Patent 78
Tread Roll 80
Forming Rolls 80
Action of Rolls 83

PAGE

What the Court of Appeals for the Third Circuit Found to be State's Invention 85
Claims in Suit 93
First Group 93
Second Group 95
Third Group 96
Defendant's Expert Criticisms 97
Initial Circumferential Stretching 98
Tread Roll 99
Spinning-Roll Action 100
Drawings Generally 102
Spiral Gearing 103
Statement of Complete Mode of Action Unnecessary 104
The Grant Patent Litigation 108
Goodyear Machines 110
Alleged Aggregation 111
Sixth Circuit Court of Appeals 112
Third Circuit Court of Appeals 113
The Infringement 114
Third Circuit Court of Appeals 116
Defendant's Position 117
Automaticity 120
Defendant's "Bight" Theory 121
Mechanical Advance of Carriage 121
The Receding Angle 122
Roll Pressing Means 124
Stretch Contention 126
Defendant's Patent 128
Core Speed Contention 131
Other Defenses 132
Minor Defenses 133
Hernandez Patent 133
Mathern German Patent 133
Vincent Patent 133
Seiberling & Stevens Patent 134
Moore Patent 135

PAGE

Jeffery Patent 136
Bayne & Subers Patent 136
Metal Spinning 137
Mathern Belgian Patent 139
The Translation 143
Mathern's General Plan 145
The Stretching Rolls 147
The Gears 36 147
The Rolls 30 148
The Tool of Fig. 6 150
Different State Mode of Operation 152
Operation of Model 153
Defendant's Specific Contentions 154
Subsequent History 158
Mathern German Patent 158
Mathern Commercial Machine 158
Court of Appeals for the Sixth Circuit on Mathern 159
Court of Appeals for the Third Circuit on Mathern 162
Authorities on Anticipation 165
Doctrine of Potts *vs.* Creager 168
The Mathern Abandonment 169
The Lapse of the Belgian Patent 169
The Differences in Translation and Expert Interpretation 170
Invention May Reside in the Combination of Old Elements, and Particularly when they Co-Operate with a New Mode of Action..... 171
New Mode of Operation 172
The Disclaimer 177
Terms of Disclaimer 180
Clause "Fourth" 180
Clause "Fifth" 181
Clauses "First", "Second" and "Third" 181
Instances of Proper Disclaimer 184
Defendant's Position 190
Court of Appeals for the Third Circuit on the Disclaimer 194

INDEX OF AUTHORITIES.

PAGE

Agawam *v.* Jordan, 74 U. S. 583..... 41, 55
Aiken *v.* Dolan, 3 Fisher, 197..... 189
Albany *v.* Worthington, 79 Fed. 966..... 193
American Valve Co. *v.* Fairbanks, 249 Fed. 234... 103

Barbed Wire Patents, 143 U. S. 283..... 171
Bates *v.* Coe, 98 U. S. 31.....120, 166, 172
Bracewell *v.* Passaic, 107 Fed. 467..... 190
Brown *v.* Guild, 90 U. S. 181..... 169
Brunswick *v.* Klump, 131 Fed. 255..... 190
Burdett Co. *v.* Elevator Co., 196 Fed. 43; affirmed 197 Fed. 743..... 121
Butte *v.* Minerals Separation, 250 Fed. 241..... 186

Cantrell *v.* Wallick, 117 U. S. 689..... 172
Carnegie Steel Co. *v.* Cambria Iron Co., 185 U. S. 421 .....166, 169, 178, 181, 190
Cimiotti *v.* American Co., 198 U. S. 400..... 169
Cimiotti Unhairing Co. *v.* American Fur Co., 120 Fed. 672 169
Cimiotti *v.* Comstock, 115 Fed. 524..... 170
Clough *v.* Gilbert & Barker, 106 U. S. 166..... 167
Coffin *v.* Ogden, 18 Wall. 120.....144, 165, 169
Cohn *v.* U. S. Corset Co., 93 U. S. 366..... 166
Coupe *v.* Royer, 155 U. S. 565..... 169
Cutler Hammer Mfg. Co. *v.* Union Electric Mfg. Co., 147 Fed. 266..... 103

Deering *v.* Winona, 155 U. S. 302..... 169
Diamond Rubber Co. *v.* Consol. Rubber Co., 220 U. S. 428.....43, 107, 108, 142
DuBois *v.* Kirk, 158 U. S. 58..... 168
Dunbar *v.* Meyers, 94 U. S. 193.....178, 190

PAGE

Eames *v.* Andrews, 122 U. S. 40 106
Eibel Process Co. *v.* Minnesota & Ontario Paper Co. 167, 175, 182, 196
Electrical Accumulator *v.* Julien, 38 Fed. 117...188, 192
Expanded Metal Co. *v.* Bradford, 214 U. S. 366... 41

Gas Machinery Co. *v.* United Gas Imp. Co., 228 Fed. 684 112
Gaylor *v.* Wilder, 10 Howard, 477..... 169
Goss Printing-Press Co. *v.* Scott, 110 Fed. 402.... 170
Grant *v.* Walter, 148 U. S. 547..... 192

Hailes *v.* Albany Stove Co., 123 U. S. 582..177, 178, 180, 190, 192
Hess-Bright Mfg. Co. *v.* Fichtel & Sachs, 219 Fed. 723 117
Hildreth *v.* Mastoras, 257 U. S. 27..... 59, 75
Hillard *v.* Book-Fisher Typewriter Co., 159 Fed. 439 170
Hobbs *v.* Beach, 180 U. S. 383.....44, 72, 168
Hopkins on Patents 173
Hoskins Mfg. Co. *v.* General Electric Co., 212 Fed. 422 66
Hurlbut *v.* Schillinger, 130 U. S. 456.....181, 190

Imhaeuser *v.* Buerk, 101 U. S. 647..... 172

Keystone *v.* Adams, 151 U. S. 139..... 173
Krell *v.* Story, 207 Fed. 946..... 121
Krementz *v.* Cottle, 148 U. S. 556..... 62

Libby *v.* Mt. Washington, 26 Fed. 757..... 188
Lockwood *v.* Hooper, 24 Fed. 910..... 187
Loom Co. *v.* Higgins, 105 U. S. 591..... 171

Machine Co. *v.* Murphy, 97 U. S. 120..... 183
Manhattan *v.* Helios, 135 Fed. 785.....179, 183
Manhattan Co. *v.* Fuller Co., 204 Fed. 287..... 103

PAGE

Marconi *v.* DeForest, 243 Fed. 56..... 189
McMichael *v.* Ruth, 128 Fed. 706..... 142
Minerals Separation *v.* Butte, 250 U. S. 336..... 186
Minerals Separation *v.* Hyde, 242 U. S. 261..... 55

National Co. *v.* Belcher, 71 Fed. 876..... 142
National *v.* Stetcher, 81 Fed. 395..... 192
National Tube Co. *v.* Aiken, 163 Fed. 254..... 112

O'Reilly *v.* Morse, 15 Howard, 62.....178, 180
Ottumwa Co. *v.* Christy, 215 Fed. 362..... 131

Page *v.* Dow-Jones, 200 Fed. 72..... 188
Parks *v.* Booth, 102 U. S. 96..... 172
Penn Electrical Co. *v.* Conroy, 159 Fed. 943..... 76
Permutit Co. *v.* Harvey Co., 274 Fed. 937; 279 Fed. 713 .....185, 194
Permutit Co. *v.* Paige, 292 Fed. 439..... 144
Potts *v.* Creager, 155 U. S. 597.....139, 168

Refrigerator Co. *v.* American Co., 171 Fed. 416.. 130
Robinson on Patents 173
Roemer *v.* Neumann, 26 Fed. 102..... 188

Sessions *v.* Romadka, 145 U. S. 41.....177, 180
Seymour *v.* Osborne, 78 U. S. 516.....166, 174
Silsby *v.* Foote, 14 Howard, 218..... 185
Simplex *v.* Pressed Steel, 189 Fed. 70..... 190
Smith *v.* Goodyear Vul. Co., 93 U. S. 486..... 169
Smith *v.* Nichols, 88 U. S. 112.....178, 190
Stead Lens Co. *v.* Kryptok Co., 214 Fed. 376..... 170
Strause *v.* Crane, 235 Fed. 126..... 193
Streator Cath. Glass Co. *v.* Wire Glass Co., 97 Fed. 950 169

Taylor *v.* Archer, 8 Blatchford, 315..... 189
Terry Co. *v.* New Haven Co., 17 O. G. 909..... 187
Thompson *v.* Bushnell, 96 Fed. 238..... 187

PAGE

Thropp *v.* DeLaski, 226 Fed. 941..... 62
Tilghman *v.* Proctor, 102 U. S. 707..... 167
Topliff *v.* Topliff, 145 U. S. 156..... 166
Tuck *v.* Bramhall, 6 Blatchford, 95..... 189

Underwood *v.* Elliott-Fisher, 165 Fed. 930..... 170

Walker on Patents.....65, 173, 177, 179
Western Telephone *v.* American Telephone, 131 Fed. 75 102
Whitely *v.* Swayne, 7 Wall. 685..... 169
Wigmore on Evidence..... 67
Wilson *v.* Chicago, 105 U. S. 566.....178, 181, 190

IN THE

Supreme Court of the United States,

OCTOBER TERM, 1923.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

vs.

FRANK A. SEIBERLING,
Respondent.

No. 185.

BRIEF FOR RESPONDENT.

The patent in suit in this case, namely, that to Will C. State, No. 941,962, granted November 30, 1909, for Pneumatic Tire Shoe Manufacturing Machine, was held invalid by the Circuit Court of Appeals for the Sixth Circuit (*The Firestone Tire & Rubber Co.* v. *Frank A. Seiberling*, 257 Fed. 74), and, subsequently, after the filing of a statutory disclaimer limiting it, was held valid and infringed by the Circuit Court of Appeals for the Third Circuit (284 Fed. 746). It is the case last referred to that is now before this Court, having been brought here by certiorari.*

There are four outstanding questions in the case, viz:

1. Did State make an invention that was patentable over the prior art?

2. Does the State patent, as limited by the disclaimer, cover that invention?

* We shall in this brief, for the sake of uniformity, adopt petitioner's practice of referring to the respondent as plaintiff and the petitioner as defendant.

3. Has the defendant infringed the patent?

4. Is the disclaimer valid?

To these questions, in turn, we will address ourselves.

Decision of the Court of Appeals for the Sixth Circuit.

Defendant relies largely upon the opinion of the Court of Appeals for the Sixth Circuit in support of its contentions. In this connection, however, it should be borne in mind that the present record, and particularly in view of the statutory disclaimer, is vastly different from that in the *Firestone* case. The Court of Appeals below found this to be the fact and stated as follows:

> "As shown in its opinion printed in the margin, the Court below conceived the case was substantially the same as that decided by the Circuit Court of Appeals of the Sixth Circuit, reported at 257 Fed. Rep., and without itself entering into a discussion of the issues here involved, it in effect followed that case. As in our view the record presented in this case is substantially different from that before the Circuit Court of Appeals in the case cited, we are justified in placing of record a full statement of the issues here involved and our reasons for reversing the decree entered below."

Rather than attempt to give a specific statement of the altered situation here, the matter will be dealt with in the detailed discussion under the appropriate headings.

Prior Tires.

For the information of the Court and in order that it may obtain a proper comprehension of State's achievement, it is believed desirable to make this brief historical rather than contentious down to the point when he produced his machine and obtained a patent for it. It is not until then that real controversy arises. The facts thus set forth are substantially undisputed or else based on the admission of defendant's witnesses. The earlier history of tires is given by Mr. Browne, plaintiff's expert.

When the automobile was introduced, there were no tires which were capable of general use thereon. There had been two types of rubber tires. The first of these were solid rubber tires, such as were used on ordinary carriages. There were also flexible pneumatic tires, such as were used upon light vehicles like bicycles and racing sulkies. These latter were generally known as "bicycle" tires, and being light as well as flexible, they were readily made by a number of processes (Vol. I, p. 430, Q. 2). The most conspicuous characteristic of the bicycle tire was its extreme flexibility, which rendered it incompetent for severe use, as it lacked sufficient stiffness or rigidity to enable it to retain its shape without reinforcement.

Automobile Tires.

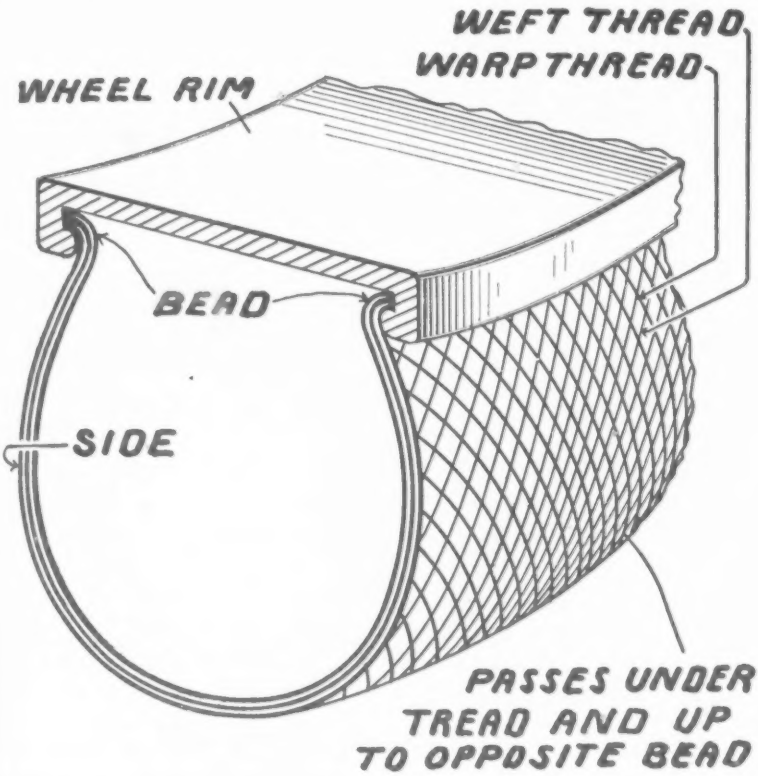
Automobile tires must be large, stiff and massive, and no one of the usual simple processes of making bicycle tires was adequate to produce them. With automobiles, very great weights must be carried, running into tons, and as compared with bicycles much greater speeds have to be endured, up to fifty or more miles an hour. Accordingly, the tires must be strong enough to sustain the lateral twisting forces such as arise in turning a corner

under speed. They must be able to withstand the effec
of the heavy pounding oscillations of the engine whic
produce violent strains on the tire in one circumferentia
direction, and they must also be able to resist powerfu
braking operations which produce circumferential strain
in the opposite direction. That is to say, automobil
tires have to sustain severe loads and strains in eve
varying combinations and in all directions.

The carcass of the automobile tire is made up of su
perimposed layers of strong fabric. In the completed tir
this carcass is concealed and covered by various layer
of rubber or rubber compound. This rubber covering i
chiefly protective in its purpose and has little capacit
in resisting strains or loads. The carcass affords th
necessary strength and resistance, it being in the natur
of a corded skeleton contained beneath the surface layer
of rubber. It is this latter element which is alone in
volved in this action and which is stated in the patent
in suit to be constructed by the machine disclosed therei
(Vol. I, p. 432, Q. 5).

It is not to be understood that the automobile tir
is without flexibility, but its vital characteristic is it
stiffness, since it is substantially permanent in structur
and shape, both when in use and when detached. It i
flexible only in the sense that it may yield under strain
somewhat in the same sense as a suspension bridge, bu
otherwise it is stiff and comparatively rigid so as to b
adequate to sustain the load carried by it and to transm
the driving force. The purpose of the carcass is to fu
nish lines of strong cords in such directions as to tak
all loads as uniformly divided between them as prac
ticable. It is for this reason that it has been likened t
the suspension bridge, wherein there is a vast numbe
of tie wires extending in such directions and with suc
anchorages as to effect the same result.

The relation of the carcass to the wheel rim of the automobile is illustrated in the accompanying cut.



It shows a perspective view of a small portion of the rim and a section of a tire carcass connected therewith. It will be seen that each cord or thread starts at one side of the tire from an anchorage at the lower edge or bead (that being the portion which is in contact with the wheel rim), and that it runs at an angle of about 45° across the upper portion or tread of the tire, and thence angularly to an anchorage at the opposite bead. This anchorage of the cords at the two beads, and the paths of the

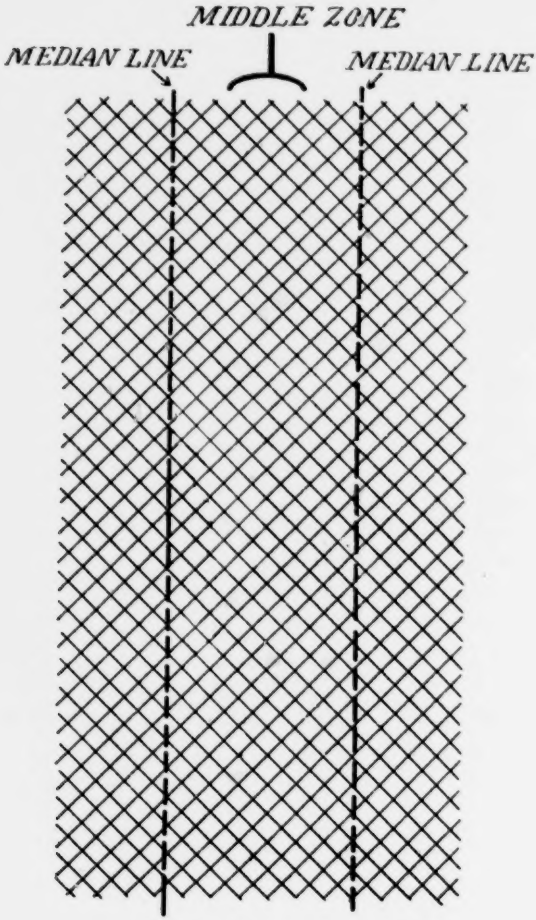
cords in diagonal lines from one bead across the tread to the other bead, is of vital importance, since the power of the engine transmitted to the wheel rims imparts motion first to the beads in contact therewith and then through the cords to the tread, which, by its contact with the ground, drives the car forward.

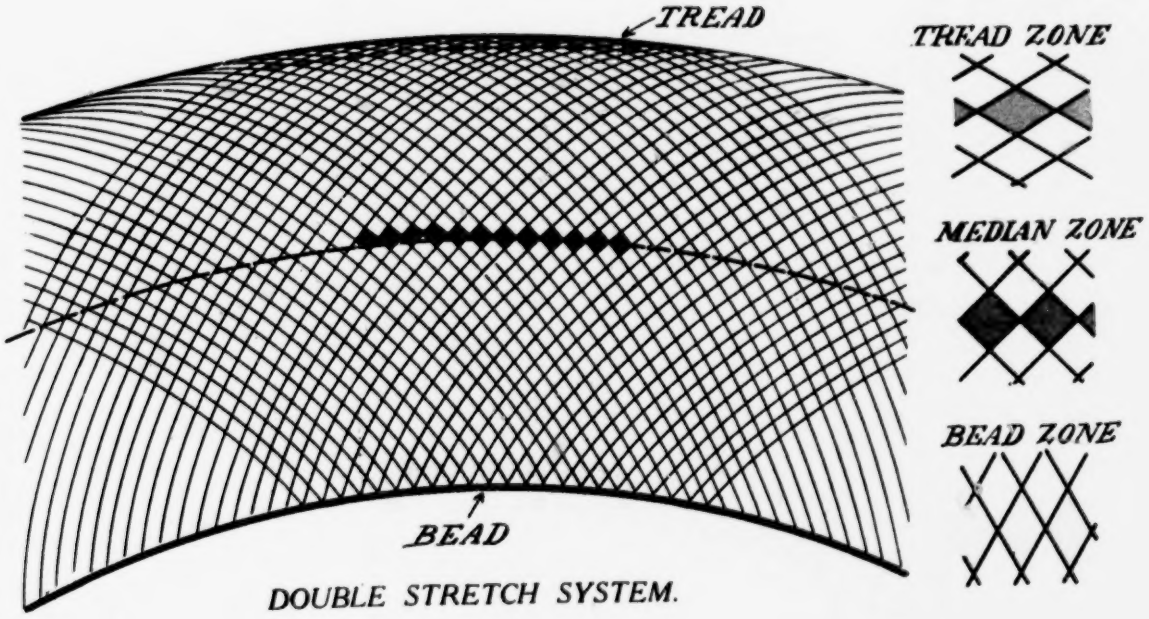
Not only must the cords of the fabric be arranged in correct position, but it is likewise important that the fabric should be smoothly laid. Wrinkles and uneven places are objectionable, because a wrinkle traps a certain quantity of air which expands when the tire is vulcanized, and rapid wear of the carcass at this point results. Again, the effect of a wrinkle is to divert the strain-taking cords from their proper paths, thus making them slack and preventing them from usefully taking the strains (Vol. I, p. 434, Q. 6).

Rearrangement of Fabric Reticulations.

The tire is formed by laying successive layers of flat fabric (previously impregnated with rubber) about a ring-core, which at its periphery is of greater circumference than at its base. It is obvious that a strip of canvas extending around the periphery of the core would be longer at its edges than the circumference of the core at the base. Thus, taking a flat strip and laying it down on the sides of the core would necessarily involve the gathering and puckering of its sides. The problem is so to shape and form the flat sheet of fabric that it will accurately and smoothly conform to the core. Plaintiff's Exhibit No. 4, Original Flat Fabric Before Shaping, reproduced herewith, illustrates the ordinary arrangement of the fabric mesh. As shown in this diagram, the threads of the fabric (known as "warp" and "weft") cross each other at right angles, but by reason of the fact that the canvas or duck is cut on the bias, each thread extends at an angle of 45° to the length of the strip. Such a strip can be stretched either longitudinally or laterally to a

ORIGINAL FLAT FABRIC
BEFORE SHAPING.



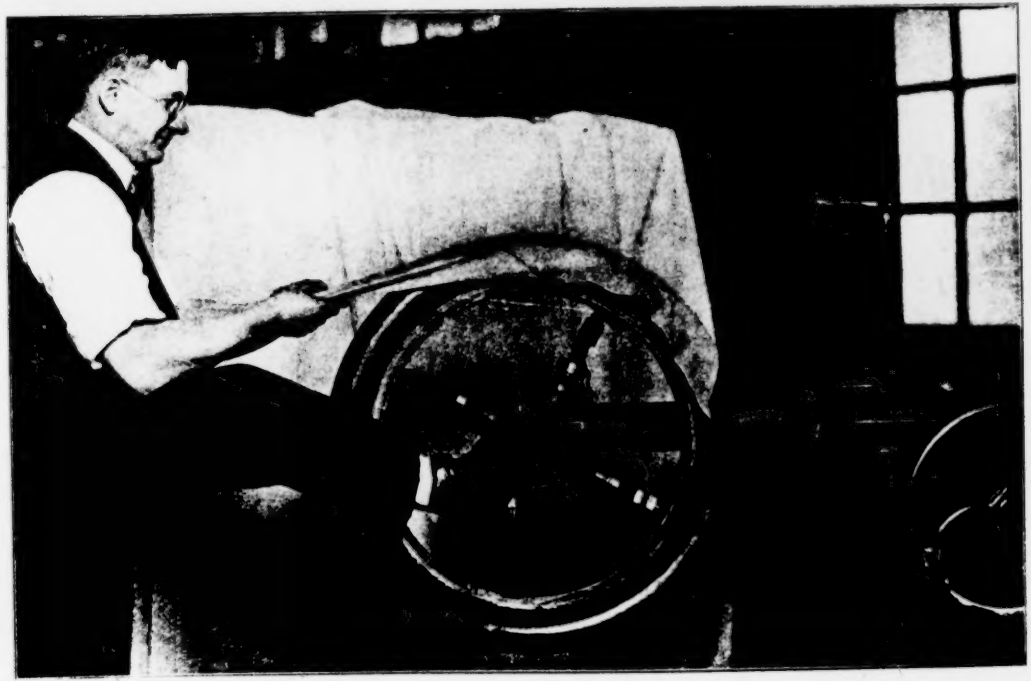


DOUBLE STRETCH SYSTEM.

limited extent without weakening the threads, and such stretching will elongate the square reticulations of the fabric and make them diamond or lozenge shaped. Further, and by this longitudinal and lateral stretching, the flat fabric is made to conform to the contour of the core.

As indicated in the diagram, the middle of the fabric can be stretched longitudinally to shape it to the periphery or middle zone of the core. This stretching will be of the maximum extent at the central line of the middle zone or tread portion, and on each side of this middle line the stretch is less and less until the circumferential lines of the core (because of their decreasing diameters) are of the same length as the original fabric. The lines where no such stretch occurs are indicatetd at the portions designated "median line" in the diagram. This leaves the outer portions or skirts of the fabric, beyond the median lines, entirely unstretched and consequently not shaped so as to conform to the inner portions of the sides of the core. But these skirts of the fabric can be stretched laterally or in the direction of the radius of the core, thus elongating the reticulations of the skirts in a direction at right angles to the previous lengthwise elongation. By this latter operation, the skirts of the fabric are radially stretched and circumferentially contracted so that they will fit snugly and without wrinkles to the sides of the core.

This effect is illustrated in Plaintiff's Exhibit No. 5, Fabric Shaped to Core, reproduced herewith. This shows the fabric finally applied to the core, and also illustrates on a larger scale in small figures at the right, the effect produced upon the crossings of the threads. As thus indicated, the threads at the tread zone are elongated circumferentially so that the original square reticulations are converted into diamonds or lozenges with the long dimension circumferential. At the median zone the fabric is not stretched either longitudinally or radially and accordingly the threads cross each other at the orig-



attached to the tread zone by circumferential stretch, after which the skirts were worked down on the sides of the core by radial stretch. State testifies to the same effect on pages 303 and 304, Vol. I. For a more connected description of the operation, reference may be had to Browne's testimony (Vol. I, p. 434, Q. 7). An exhibition of this hand practice was given in the Court of Appeals below.

There was employed a revoluble ring-core, the surface of which had the shape in cross-section of the inside of the tire carcass. This was mounted on a swivel so that the core could be placed either in vertical or horizontal position. The core being in a vertical plane, the end of the strip of fabric, previously made sticky by the impregnation of rubber, was secured to the core at one end, whereupon the core was held fast against rotation and the operator forcibly pulled the fabric toward him. By a repetition of such pulls the central region or middle zone of the fabric, that in contact with the convex tread portion of the core, was stretched longitudinally with respect to the length of the fabric and circumferentially of the core. This operation is illustrated in Plaintiff's Exhibit No. 11, Manual Circumferential Stretching, reproduced herewith.

The workman by his successive efforts stretched the central zone of the strip until it extended entirely around the core and its two ends overlapped each other. The result of this hand stretching of the middle zone was to elongate that portion of the fabric so that it conformed to the tread portion of the core. This left the skirts of the strip not only unattached to the sides of the core, but in a loose and baggy condition, as indicated in the picture. So much for the first or circumferential step of the double stretch method.

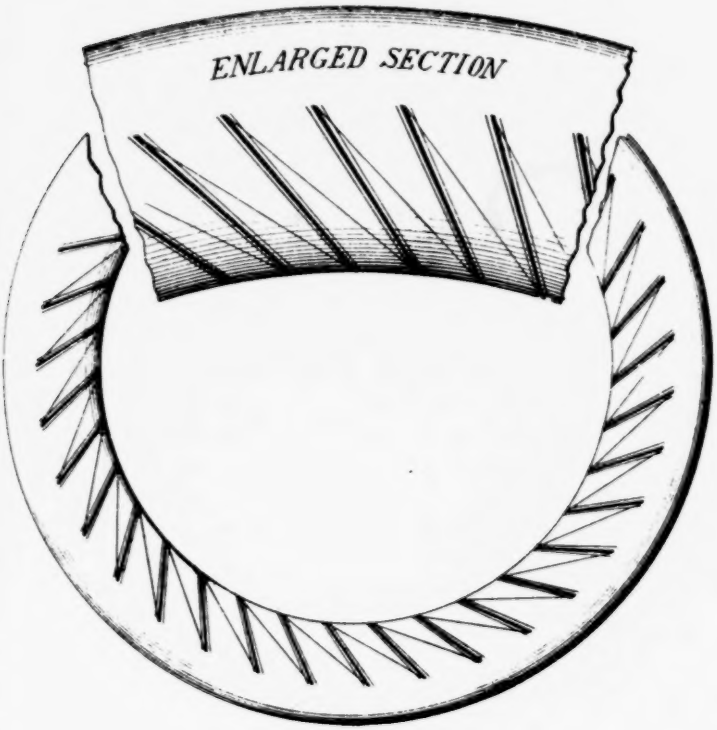
To finish the application of the fabric to the core in a smooth and unwrinkled condition, it was necessary to get rid of the looseness in the skirts during their applica-

tion to the sides of the core. This was accomplished by the action of the workman with a hand-held tool, either a wooden spatula called a "paddle", or else a "stitcher" consisting of a rotatable disc mounted in a handle. The characteristic action of forming and shaping the loose skirts of the fabric to the sides of the core was the reciprocation of this tool by one hand of the workman in a direction approximating to the radius of the core, this reciprocation being effected along one line and its return by a more oblique path to another line, where the reciprocation was repeated. The line along which the tool was thus moved is indicated in Plaintiff's Exhibit No. 7, Sketch of Sawtooth Method, reproduced herewith. Because of its serrated path, which resembles in form the periphery of a circular saw, the name "sawtooth" has been employed to designate it.

While the workman reciprocated the tool by one hand, he held the edge of the fabric with his other hand and pulled it so as to keep it taut. The consequence was that the reciprocating movement of the tool gathered a small amount of fullness at each stroke, the tendency being to make a great number of little tucks or flat arches which were so skillfully formed that they were ironed out almost as a part of the act which produced them. In this way the workman stretched the fabric radially and at the same time pressed it against the sides of the core, the radial stretching conforming the skirts to the sides of the core in a manner analogous to that in which the circumferential stretching fitted the middle portion to the tread zone. This constituted the final step of the double stretch method.

The foregoing hand practice is the one described by the Sixth Circuit Court of Appeals in that portion of its opinion quoted by Judge Buffington. It was not confined to the Goodyear plant but was the common and standard practice employed by the great majority of other tire companies, as will later appear.

SAW TOOTH PATH OF HAND TOOL



For completeness, it may be stated that if the fabric was not perfectly formed by the sawtooth manipulation, or if wrinkles or blisters remained, the defects were corrected by hand tools. Doctoring of this description is resorted to in connection with all tires, whether made by hand or by machine, although the necessity is reduced to a minimum by the machine of the State patent in suit.

Single Stretch Method.

There was still another method employed by some other companies, and it is important at the outset to note the distinction. *This was the "single stretch" method, which relied on circumferential stretching alone to shape the fabric to the core. No radial stretching was used at all.* It was possible to form the fabric to the core and down to the bead by circumferential stretch alone, much in the same manner as indicated in the previous picture of the workman. Of course the action produced a condition of the reticulations quite different from that shown in Plaintiff's Exhibit No. 5, wherein are illustrated circumferential diamonds at the tread and radial diamonds at the bead. When circumferential stretch alone is employed, the reticulations at the bead are not diamonds but squares (Ray, Vol. I, p. 569, Qs. 138, 139). Plaintiff's Exhibit No. 34, Tire Made by Circumferential Stretch, exhibits this clearly. As the witness points out:

> "Q. 138. And do you find diamonds in the bead portion of this tire, Plaintiff's Exhibit No. 34?
>
> A. No, there are squares in the bead portion.
>
> Q. 139. Are there any diamonds at all in the fabric of this exhibit tire?
>
> A. There are no diamonds with their long axes radial, but on the sides of the tire there are diamonds with their long axes circumferential, which become more pronounced toward the center of the tread portion of the tire where they are at maximum."

The picture reproduced herewith shows the long diamonds at the periphery and the squares at the bead. The marked contrast between the two systems of single stretch and double stretch will be apparent upon a comparison of this diagram with that previously referred to. Seiberling (Vol. I, p. 395, Qs. 64 *et seq.*) refers to the use of the single stretch system by other companies. State also describes it (Vol. I, p. 304, Qs. 16, 17).

Advantages of Double Stretch Method.

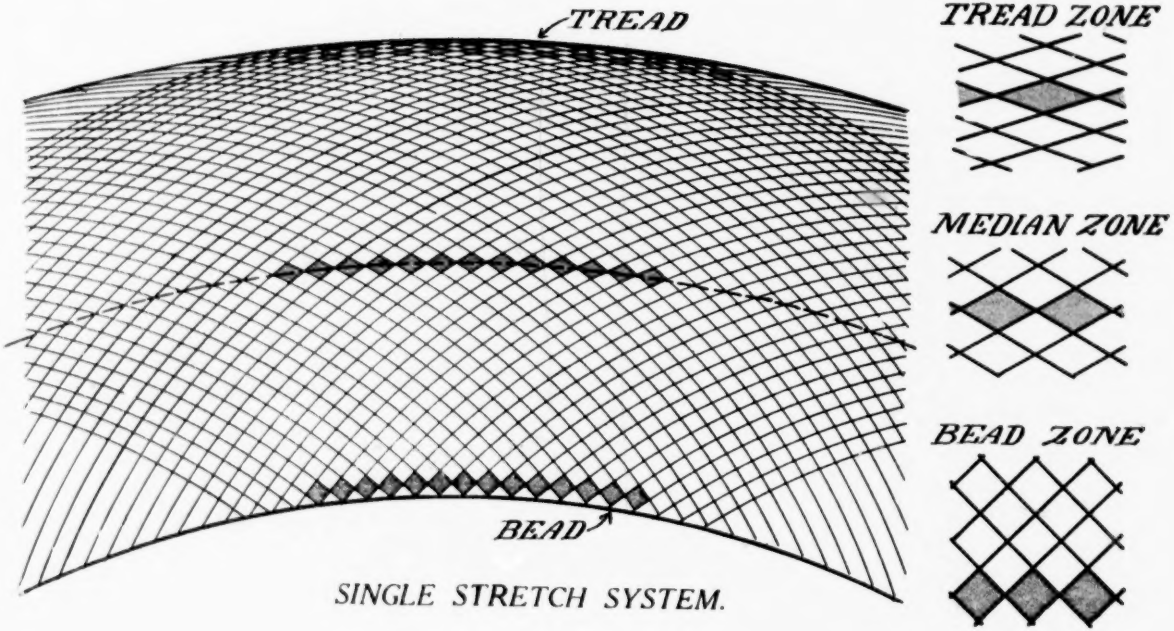
The advantages of the double stretch method are obvious almost without elaboration. Naturally, if the fabric was stretched only circumferentially and not radially, the result was unbalanced. There would be too much stretch in one direction and none in the other. Seiberling testifies as to the Goodyear preference (Vol. I, p. 397):

> "Q. 84. Why was it the Goodyear Company has preferred the combined circumferential and radial stretch method to the single circumferential stretch method in the manufacture of tires?
>
> A. Because the fabric when applied is under less tension, and it makes a stronger carcass."

State testifies similarly (Vol. I, p. 305):

> "Q. 20. Can you tell me why the Goodyear Company made its tires with what I may term the 'double-stretch' method, instead of by the 'single circumferential-stretch' method?
>
> A. We think it made a better, uniform, balanced tire.
>
> Q. 21. And that was regarded as superior to the single-stretch (circumferential) method?
>
> A. Yes."

Moreover, the exact percentages of stretch are given. Seiberling says that in the Goodyear double-stretch hand



SINGLE STRETCH SYSTEM.

method (Vol. I, p. 387, Q. 8) the amount of circumferential stretch was "10 or 12 per cent.", and (Q. 12) the amount of radial stretch was "the same or a little more than the circumferential stretch". This indicates the substantial uniformity of tension in both directions. The percentage of circumferential stretch in Goodyear hand practice is confirmed by State, who says (Vol. I, p. 303, Q. 10) that it was about 12 per cent. This testimony is in accord with that to the effect that in this way was produced a tire having substantially uniform tension throughout.

It is more difficult to state with precision the exact line of demarcation between the two systems, but a fair consensus of opinion, as gathered from the testimony of defendant's witnesses, seems to be that a circumferential stretch of 17 per cent. or more (as to the sizes referred to) indicates the single stretch method. For instance, as hereafter shown, the Vincent machine admittedly embodies the single or circumferential stretch method, and there the percentage was 18. At this point radial stretch either has disappeared entirely, or, if any remain, is so inconsiderable as fairly to be disregarded.

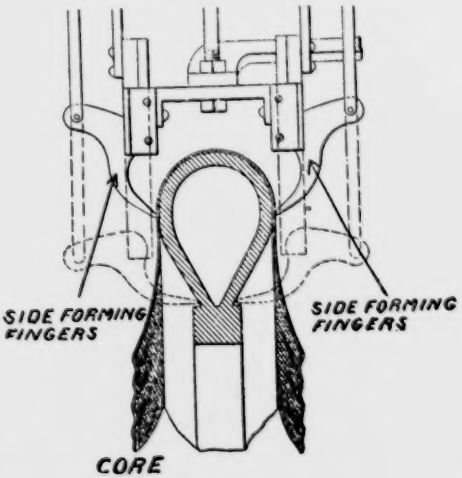
The matter of *the distinction between the two stretch methods* becomes *especially important for the reason that the State machine, as well as defendant's machine, embodies the double stretch system.* On the contrary, *the single stretch method was employed in the three alleged anticipations* on which defendant lays its greatest stress, *namely, Vincent, Mathern, and hand spinning.* Defendant's expert endeavors to place defendant's machine within the single stretch system, but the contention is untenable for many reasons. For instance, Curtis, defendant's employé, admits (Vol. I, p. 299, x-Q. 66) that defendant is "using about twelve per cent. as a standard", which is exactly the same as that used in the State machine.

The Seiberling & Stevens Machine.

Proceeding with the history of the Goodyear Company in its endeavor to supplant the hand-making of tires by machinery, and remembering that its tires were of the double stretch type, the first and natural suggestion would be the endeavor to embody the sawtooth method in a machine. And this was what actually occurred, as testified to by State, Vol. I, pp. 305 to 307. This was in 1903.

The machine was equipped with fabric delivery means and tension mechanism to secure the circumferential stretch, leaving the skirts unattached in the manner previously described. It was then sought to stretch the skirts radially and apply them to the side of the core, and for this purpose was employed a pair of "jigger fingers", which reciprocated radially on the sides of the core in a path somewhat like that indicated in our pre-

SEIBERLING & STEVENS



vious sawtooth diagram. But the effort failed, as (Vol. I, p. 306, Q. 30) the jigger fingers did not form the fabric

properly. Some commercial tires were made on the machine, but it was finally abandoned and junked. The Court of Appeals for the Sixth Circuit, in referring to this machine, stated as follows:

> "One machine was built, but there is evidence that no tires were successfully made upon it, and that the jigger fingers would not smooth the sides so as to make first-class tires. Certainly, its attempted use by the Goodyear Company was abandoned, the machine discarded, and no other ever built."

The Court of Appeals for the Third Circuit found likewise:

> "Seiberling and Stevens' plan was to use jigger fingers, but the proof is that their jigger-finger machine was not commercially successful and was commercially scrapped."

The Seiberling & Stevens patent purported to cover this machine and was urged in the earlier litigation in the Sixth Circuit, although principally in relation to the means for obtaining the original circumferential stretch. The particular point need not be considered in the present case, which for the most part, is directed to the means for obtaining side-forming by radial stretch,—the second step of the double-stretch system. Therefore, although originally set up in the bill, plaintiff has dropped the Seiberling & Stevens patent. Moreover, it is now expired.

The Vincent Machine.

Even though it may slightly interrupt the consecutive narration, this seems to be the appropriate place to refer to the only other machine on which effort was made to produce tires commercially, viz., the Vincent machine. This is testified to by defendant's witness, Raymond (Vol. I, pp. 187 to 190).

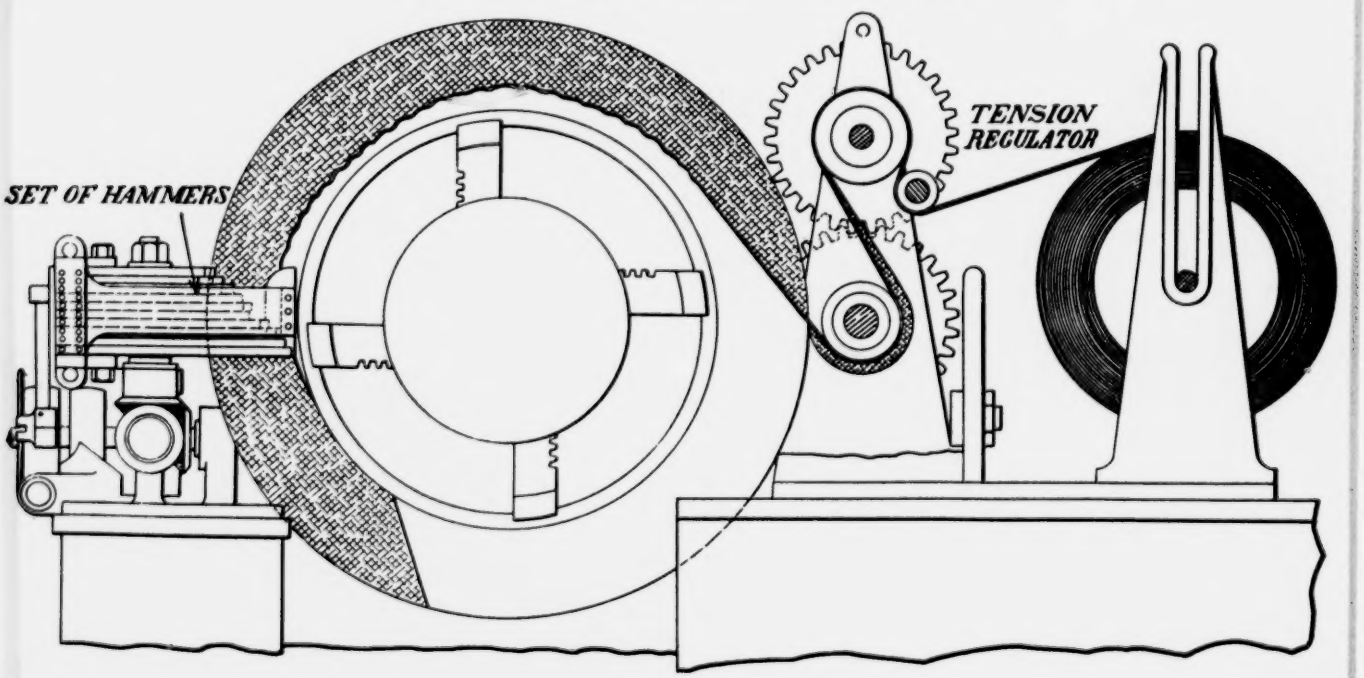
The Goodrich Company began to use it in the early part of 1907 and the witness says that some thousands of tires were produced upon it. He admits that only

a single machine was installed and that it was quickly superseded by the present Goodrich machine. So far as we know, certainly so far as the record indicates, this was the only Vincent machine ever employed in this country. Raymond says (X-Q. 15) that he knows of no similar Vincent machine now in use. Seiberling confirms this (Vol. I, p. 396, Qs. 69, 70) in stating that it was used by the Goodrich Company for "one season for a short time, and then consigned to the scrap heap", and that he knows of no other Vincent machines now in operation. There is no commercial success in such a history as this.

Even were it otherwise, there is proof that the Vincent machine was in no sense a precursor of State's machine, and for the reason that it did not operate on the double stretch system. Raymond admits (X-Q. 32) that the circumferential stretch was 18 per cent., and (X-Q. 33) that the fabric was thus "pretty well stretched down over the sides of the core". Further, referring to the Vincent machine, defendant's expert admits (Vol. I, p. 254, Q. 43) that "*it stretches the fabric so nearly to the final shape that spinning-rolls are not necessary.*" This is conclusive. In State's machine the double stretch method is adopted and spinning rolls *are* necessary.

In Seiberling's deposition (Vol. I, pp. 401, 402) appears a letter from Milan he wrote his brother in 1907, in which he repeated what he had been told about the Vincent machine in Italy. However, the user was "not permitted to show it", and all Seiberling knew about it was what was told him. He says (Vol. I, p. 412, Rd-Qs. 204, 205) that he had not seen the machine and that the statements he made were "based entirely on hearsay". In reply to this letter, Seiberling received a cable from his brother (Vol. I, p. 389, Q. 25) "not to make any arrangement" as "State had gotten up a machine that had excellent promise". This was the period when the State machine was under development.

VINCENT HAMMER PATENT



The Two Prior Machines of Seiberling & Stevens and Vincent.

These two machines, that of Seiberling & Stevens and that of Vincent, constitute everything there is in the nature of actually built machines prior to that of State in so far as relates to the manufacture of tires at all like those here involved.

When the State application was pending in the Patent Office, both Seiberling and State filed affidavits to the effect that the State machine was the first to make tires *commercially*. Both referred to the Vincent machine and pointed out that it had been abandoned. The record here completely confirms the accuracy of their statements. The Seiberling & Stevens machine produced a few commercial tires, and the Vincent machine a larger number. But both were abandoned and junked, and both have disappeared from use. As an interesting sidelight, it is pointed out that in Seiberling's letter to his brother he states, "Perelli is averaging almost 5 tires *per man per day*". This was the extravagant claim made on behalf of the Vincent machine in 1907. The State machine makes more than that number *per man per hour*.

Hand Spinning.

This subject is of primal importance, since the dismissal of plaintiff in the District Court, in this case, was based upon it. The topic was not mentioned in plaintiff's proofs in the Firestone litigation. Defendant here advances hand spinning as in effect anticipatory of State's invention, whereas plaintiff regards it as corroboration of the inventive act. Defendant in the *Firestone* case treated it very briefly in its testimony, in fact, so slightly that plaintiff regarded it as of no importance and did not respond. The Court of Appeals in that case said of it:

> "* * * *Considered critically, all this testimony might not be sufficiently definite and positive to pre-*

> *vail by itself against circumstances tending to throw doubt upon it;* but there are no such circumstances. When defendant's proofs closed, this proposition would ordinarily be taken as fairly established; Messrs. State and Seiberling were called as witnesses on the rebuttal; both were familiar with the history of the art; neither one denied or questioned this proposition; nor did any other witness for plaintiff."

Plaintiff thought with the Court that the testimony was not "sufficiently definite and positive to prevail by itself", and for that reason made no attempt to rebut it. However, the point will now be discussed at length and with the belief that it confirms plaintiff's contentions as to State's achievement.

Although it was not Goodyear Company practice and seems to have been unknown in its factory, there was elsewhere in vogue a certain method of making tire-carcasses known as "hand spinning". The name suggests the nature of the procedure, but to make it clearer we refer to the testimony of defendant's expert (Vol. I, p. 268, Q. 58), who first describes the original circumferential stretch and then relates how the operator applied the fabric to the side of the core in the following language (Vol. I, p. 269):

> "* * * He then caused the core to rotate rapidly and, taking a hand stitcher, applied it to the side of the core at about the edge of the part of the fabric which was adhering to the core, and then moved the hand stitcher radially inwardly while the core was in motion, pressing the stitcher laterally against the core all the time. This operation spun down the fabric on one side of the core, and it was then repeated on the other side of the core. The hand stitcher used was a disk-like metallic wheel or roller having a rounded edge and about two or three inches in diameter. It was mounted to revolve in a wooden handle."

He does not allege that the action he describes resulted in stretching the skirts of the fabric radially, as is essential to secure the double stretch method. Nor does he even allege that there was a high enough core speed to produce the necessary centrifugal force to obtain radial stretch. As defendant's witnesses testify, the core speed was altogether too low to secure this effect. *Hand spinning was in the single stretch class.* The original circumferential pull was relied on to shape the fabric to the core. The cuts in defendant's brief (pp. 4-5) are unwarranted, as the fabric strip is there shown as applied to the core with practically no circumferential stretch at all. Defendant's witness, Walch, says (Vol. I, p. 286, Q. 6) that they pulled "it on just as hard as we could"; and defendant's witness, Duncan, testifies (Vol. I, p. 197, x-Q. 28) that they preferred seventeen per cent. of stretch because that secured "the best position on the side of the tire which could be obtained with manual stretching". As Duncan says (Vol. I, p. 202, x-Q. 56), "The important thing is the stretch". And he repeats (p. 203, x-Q. 58) that the circumferential stretch applied initially is the important thing, and even says that the amount of subsequent side pressure "need be only sufficient to apply the fabric smoothly"; as will be subsequently shown, uniform and heavy side pressure is essential to radial stretching. After the fabric was entirely or largely pre-formed by circumferential stretching all that was done was to apply it smoothly to the core, and that is all defendant's expert describes in his testimony, *it being again noted that he nowhere refers to high speed or centrifugal force or radial stretch.*

There can be no dispute as to the proofs now to be analyzed, since they are practically all the admissions of defendant's witnesses.

Hand spinning forbidden. First, it should be noted that hand spinning was prohibited by the Dia-

mond Company. This is significant, since defendant places its main reliance on the Diamond practice and the majority of its witnesses were Diamond employés. Not only was it forbidden, but its practice was regarded almost as a "criminal offense", as stated by one of defendant's witnesses. Why it was so regarded will be apparent later on. The authorized practice was the saw-tooth double-stretch hand method.

Defendant's witness, Koplin, testifies (Vol. I, p. 95) not only that it was against the rules, but that the saw-tooth method was the regular one:

> "x-Q. 29. Did you ever run down tires by hand after you became inspector?
>
> A. Not after I became inspector I didn't. The reason I didn't after I was inspector, I was breaking in new men about half the time; I was breaking in new men and inspecting both.
>
> x-Q. 30. When you broke in new men, did you teach them to run down tires in the same way?
>
> A. No.
>
> x-Q. 31. Why not?
>
> A. Because it was against the rules.
>
> x-Q. 32. What were the rules that you followed in breaking in new men?
>
> A. Why, to stitch the plies down by hand.
>
> x-Q. 33. When you say 'to stitch the plies down by hand', do you mean that the ply was stitched down in a path something like as shown in this picture that I hand you? (Plff.'s Ex. No. 7.)
>
> A. Yes. Yes, a good deal in this form. Of course, you know, after we would break them in, they would naturally break away from the hand-building, and, as I told you before, spin the tire."

Defendant's witness, Derry, testifies (Vol. I, p. 110):

> "x-Q. 33. What method were you taught when you went to the Diamond Company?
>
> A. You was taught to pull your plies on, stitch them down with a stroke.
>
> x-Q. 34. You mean somewhat after the fashion indicated in Plaintiff's Exhibit No. 7?

A. Yes, that's all right. Yes, sir, that's what we call the stroke.

x-Q. 35. That was the method you were taught?

A. Yes, sir.

x-Q. 36. Did you have any difficulty in spinning the core on the stands that were in use at the Diamond plant?

A. Only difficulty ever I had was to keep away from the boss on it.

x-Q. 37. In other words, that spinning method of making tires was not approved by the inspector, the authorities at the Diamond?

A. No.

x-Q. 38. And for that reason you were taught the saw tooth method?

A. Yes, sir."

And again (Vol. I, p. 113):

"x-Q. 61. I understand you used this hand-spinning method only when the boss wasn't looking?

A. Yes, sir.

x-Q. 62. What would have happened if he had seen you doing it?

A. A bawling out, I suppose."

Defendant's witness, Drach, although contradicting himself repeatedly, states (Vol. I, p. 104) that the hand spinning method was *finally abandoned* in favor of the sawtooth method to get better radial stretch:

"x-Q. 52. Then I understand your testimony to be that in 1910 the Diamond Company changed from the hand-spinning method to the stitching method, as indicated in this Plaintiff's Exhibit No. 7?

A. Over the bead.

x-Q. 53. What was the reason they gave for changing from the hand-spinning method to this other stitching method, in 1910?

A. Well, the stock—the stock was narrow; they changed and made it wider, and had to stretch it more.

x-Q. 54. And, to get this greater stretching, they

used the stitching method shown in this Plaintiff's Exhibit No. 7?

A. Yes, at the top of the bead they done that.

x-Q. 55. And you understood that you could get more stretching with this stiching method shown in Plaintiff's Exhibit 7 than you could in the hand-spinning method? I mean that's what they told you?

A. Yes."

Defendant's witness, Heller (Vol. I, p. 119, x-Qs. 38 to 44) confirms and describes the use of the sawtooth method at the Diamond plant.

Defendant's witness, Stark, testifies to the same effect (Vol. I, p. 133, x-Qs. 73 to 75).

Defendant's witness, Green, says that the hand spinning method was the only one in vogue at the Diamond plant, but subsequently contradicts himself and finally admits (Vol. I, p. 141, x-Qs. 54, 55) that tires were made there by the sawtooth method.

Defendant's witness, Gregg, says in effect that instructions were to work down the tire "with stroke", but that hand spinning was also performed (Vol. I, p. 147):

"Q. 11. Describe how you worked the fabric edges down on the sides of the core with the stitcher.

A. Well, if we worked it down according to our instructions, it was done with stroke. Often they would spin the core, and then would hold the stitcher against the sides of the core; hold the stitcher there —of course, if we had speed enough to start with, we would run it clear down."

He explains further (Vol. I, p. 149):

"x-Q. 28. You have referred to the method you were taught when you went to the Diamond Company. Did that method involve the use of the stitcher in a saw tooth path substantially like that shown in the sketch Plaintiff's Exhibit No. 7?

A. Yes."

Defendant's witness, Bittaker, testifies in effect that the operator was instructed to use the sawtooth method (Vol. I, p. 181):

"x-Q. 55. Now, is it not a fact, Mr. Bittaker, that the operator was expected and instructed at this time, in the Diamond plant, to form the sides or skirts of the fabric to the core by a succession of short strokes inward toward the center of the core, and at a slight angle thereto?

A. Yes.

x-Q. 56. In other words, by what is known as the 'hand-stitching method', as distinguished from the hand-spinning method?

A. Yes.

x-Q. 57. That is to say, the path of the stitcher in this authorized form was substantially like that shown in the sketch I exhibit to you, and which is marked 'Plaintiff's Exhibit No. 7'?

A. Substantially like it, with the exception that the angle may not have been exactly the same."

Bittaker is the witness who refers to the hand spinning method as a criminal offense (Vol. I, p. 175):

"Q. 18. How fast did the man rotate the core while stitching down the fabric?

A. In the early stages of the tire construction, rotating of the core while stitching down the plies was sort of termed as a criminal offense among the employees. Shortly after the tire construction had advanced, it was more common to see the workmen rotate the core at a very high speed while applying the fabric with the stitcher."

He explains further (Vol. I, p. 181):

"x-Q. 58. Why did the authorities at the Diamond plant think, at the outset, that the hand-spinning method was detrimental to the tire?

A. Well, I stated previously that it was theoretical that they condemned that practice at first, thinking that the threads which composed the fabric could not be kept at a 45-degree angle."

Defendant's witness, Mell, testifies as to the practice at the Republic plant (Vol. I, pp. 153, 154, Qs. 11 to 14), the substance of his statement being that hand spinning was employed "half way down" the skirt and then the remainder was stitched down by the sawtooth method. This was the general practice (Vol. I, p. 155, x-Q. 19), and the description is further supplemented at Vol. I, p. 158, x-Q. 33. The use of the sawtooth method over the final and more difficult half of the skirt indicates the desire to obtain more radial stretch than was possible by hand spinning.

Defendant's witness, Walch, testifies to the use of the spinning method at the Ajax plant, but admits (Vol. I, p. 288, x-Qs. 24 to 26) that the operators were taught the sawtooth system.

Defendant's witness and employé, Curtis, testifies to the early use of hand spinning, but admits (Vol. I, p. 296, x-Qs. 33 to 36) the employment of the sawtooth method in the Thropp plant. His testimony is further qualified (Vol. I, p. 298, x-Qs. 49 to 51) by the statement that at the Thropp plant only the first ply was laid down by hand spinning, after which the subsequent plies, already prewoven to circular shape, were "spaded" down, this term implying the sawtooth method.

Great skill required for hand spinning. As further indicative of the conditions, a number of witnesses refer to the skill and experience necessary to perform the hand spinning operation.

Defendant's witness, Koplin, for instance, testifies (Vol. I, p. 95):

> "x-Q. 24. How do you know that it was a year and a half after you went into the Diamond employment that you began to spin down tires by hand?
>
> A. It was about that time. Why, a man has to have experience in the business quite a bit before he can do that.

x-Q. 25. You think, then, that it took you *a year and a half of experience* before you were able to run down tires by hand; is that what you mean?

A. Yes, so as to be a success, so they wouldn't wrinkle.

x-Q. 26. In other words, it required some skill and experience to prevent the fabric from wrinkling?

A. Yes."

And again (Vol. I, p. 96):

"x-Q. 34. You didn't think it was safe to let the new men do it until they had considerable experience?

A. Yes, it was not safe."

Defendant's witness, Mell, says (Vol. I, p. 154):

"Q. 14. About how much of the fabric on the side was laid down by the use of the stitcher; I mean how much in a radial direction?

A. Probably about half way down the side which depended somewhat on the skill of the operator, an expert tire-maker being able to roll it down further than a green operator."

Defendant's witness, Drach, says (Vol. I, p. 103, x-Q. 37) that it was difficult for a new man to "spin the core and stitch it down". Defendant's witness, Walch, testifies (Vol. I, p. 288, x-Q. 24) that "it was quite a knack to do it with the stitcher. We learned a lot of new men and they did not quite get the knack of doing it right away".

Large circumferential stretch and corresponding absence of radial stretch in hand spinning. In effect, hand spinning comes within the single or circumferential stretch system, and is distinguished from the Goodyear double stretch system. This becomes apparent in many ways. As a general rule, defendant's witnesses are unable to give or even estimate

the amount of circumferential stretch, and this is not surprising. For instance, Walch says (Vol. I, p. 286, Q. 6) they pulled it on "just as hard as we could". Sometimes it was put on by *two* men (Bittaker, Vol. I, p. 176, Q. 26). However, there are one or two notable exceptions, as for instance, Duncan, who is a graduate of the Massachusetts Institute of Technology. His statements are most illuminating, since they clearly indicate the use of the single stretch method (Vol. I, p. 197):

> "x-Q. 27. What did you say was the average stretch employed in connection with hand made tires such as you have already referred to?
>
> A. This will vary with different companies. We preferred to get seventeen.
>
> x-Q. 28. Why did you prefer to get seventeen per cent. of stretch?
>
> A. Because that brought what we called the neutral line of fabric to the best position on the side of the tire which could be obtained with manual stretching."

This is further confirmed by his testimony to the effect that circumferential stretch is the important element and governs radial stretch (Vol. I, p. 202):

> "x-Q. 56. In other words, do you regard the amount of pressure on the core as immaterial, so long as the fabric is applied thereby smoothly to the core?
>
> A. Yes. The important thing is the stretch.
>
> x-Q. 57. You mean radial stretch, do you not by your last reference to the stretch?
>
> A. I mean circumferential stretch because that governs radial stretch.
>
> x-Q. 58. Then if I understand you correctly, you regard the circumferential stretch applied initially as the important thing, and the amount of side pressure subsequently applied as relatively unimportant.
>
> A. Yes, the amount of side pressure need be only sufficient to apply the fabric smoothly. The adhesion is obtained during the molding operation."

Defendant's witness, Mell, also a mechanical engineer, confirms the small amount of radial stretch (Vol. I, p. 157):

> "x-Q. 30. I suppose that, in connection with a core of small cross-section, the amount of subsequent side-forming is inversely proportional to the initial circumferential stretch; is that correct?
>
> A. I say yes.
>
> x-Q. 31. For instance, you take a core of small cross-section, say three inches across; and then you stretch the fabric thereon so as to get an 18 or 20 per cent elongation; there is very little additional forming action necessary to apply the fabric to the side of the core; is that correct?
>
> A. Yes, not a great deal of additional forming need be done. However, the fabric had to be applied without wrinkles; and even on a small tire this took considerable care, the fabric never coming down where it lay on the core in its correct position."

The inability to obtain adequate radial stretch by spinning is further indicated by the fact that the system was applicable only to the smaller sizes of tires, as next to be discussed.

Hand spinning not applicable to large tires. Defendant's witnesses agree that hand spinning was used entirely in the production of small tires and that the larger sizes had to be made by the sawtooth method. The reason for this is obvious. There is a safety limit to the stretching capability of tire fabrics, and with cores of larger section that limit would be quickly reached. Going beyond it, the fabric would be over-stretched and weakened. With larger cores the only practical way of applying the fabric was by dividing the stretch under the double stretch system, as by the sawtooth method generally employed for the purpose. The witnesses are practically unanimous as to the facts:

Defendant's witness, Koplin, testifies (Vol. I, p. 96):

"x-Q. 35. Did you ever use this hand-spinning method continuously all day at the Diamond plant?

A. No, I couldn't do it only on small tires. The large tires the fabric was too stiff."

Defendant's witness, Derry, says (Vol. I, p. 113):

"x-Q. 65. Why didn't you use the spinning operation on the larger-size tires also?

A. It wouldn't work as well.

x-Q. 66. Why not?

A. Too much fabric. The wider the plies, the harder they are to pull on by hand. We didn't have any machines in those days."

Defendant's witness, Heller, states (Vol. I, p. 119):

"x-Q. 46. In other words, you found the hand-stitching method more difficult to perform in connection with the larger-size tires because there was a greater amount of fabric to shape down on to the core; is that correct?

A. Yes.

x-Q. 47. You understand, of course, that I am now talking about the hand-spinning method?

A. Yes, sir."

Defendant's witness, Green, testifies (Vol. I, p. 138):

"x-Q. 35. Was that the case with all sizes of tires at the Goodrich plant?

A. On different sizes that I worked on it would work out that the smaller tire would work better."

Defendant's witness, Gregg, is particularly explicit (Vol. I, p. 149):

"x-Q. 30. In using the hand-spinning method you have been taking about, did you use it on all sizes of cores?

A. No, sir. Only on the smaller sizes, anything from 4-inch down."

And again (Vol. I, p. 150):

"x-Q. 38. In using the spinning method on the larger-size tires, did you have any other difficulty than that involved in imparting the proper momentum to the heavy core?

A. Yes, sir.

x-Q. 39. What were these other difficulties?

A. We had the difficulty of keeping the fabric from—well, you might say wrinkling.

x-Q. 40. There was a tendency to wrinkle, was there, in the plies of the larger-size tires?

A. Yes, sir."

And again:

"x-Q. 42. If I understand you correctly, what you mean to say is, that, in the tires of larger cross-section, there was more fabric to lay down; and, for that reason, it was more difficult to do it by the spinning method; is that correct?

A. That expresses the idea, yes.

x-Q. 43. In connection with these tires of larger cross-section, when you pulled the strip onto the core, there would be a greater amount of side-stretch along the edges of the strip, would there not, than in connection with cores of smaller cross-section?

A. I don't believe that one answer can be applied to all cores. I think there would be more loose fabric in a large tire on the edges of the ply; I mean on large cross-section tire.

x-Q. 44. And this rendered more difficult the subsequent absorption of this fullness in the sides of the tires?

A. Well, you are right. There is a point, probably, you may not know in this tire business. Now, for instance, in some of these larger sizes the bead is set further in from the outer periphery of the core; and consequently there was more fabric to absorb.

x-Q. 45. And consequently, in these cases, you applied the skirts of the ply to the sides of the core, or of the tire, by the sawtooth method of stitching?

A. Supposed to."

It is believed to have been shown that hand spinning can not be used advantageously to lay the fabric on the larger cores, or when the fabric is stiff or in considerable quantity, and that to effect the desired result more radial stretch is necessary, as in the sawtooth method. This is further confirmed in the testimony:

Defendant's witness, Green, states (Vol. I, p. 145):

> "Rx-Q. 90. When would the sawtooth method work better?
>
> A. Why, if the fabric was stiff and hard, it would be easier to get it down that way."

And again:

> "Rx-Q. 93. Therefore, when you were handling a layer of fabric that was stiff and hard, you would use the sawtooth method to shape it down?
>
> A. Yes, sir. It would work it better that way."

Defendant's witness, Drach, says (Vol. I, p. 105):

> "x-Q. 55. And you understand that you could get more stretching with this stitching method shown in Plaintiff's Exhibit 7 than you could in the hand-spinning method? I mean that's what they told you?
>
> A. Yes."

By way of anticipation, it may be noted here that *State was forced to revolutionize the spinning method, and that one of his principal feats was the introduction therein of sufficient radial stretch to convert it into the double stretch system.* This improvement not only met the Goodyear requirement, but also gave the balanced tire with uniform tension. As hereafter discussed, the proofs show that by the State machine radial stretch as high as fifteen per cent. may be secured.

Core speed irregular in hand spinning. As will appear later, one of the absolute requirements to secure radial stretch is a rotative speed of the core which

is not only high but also uniform. Neither of these requisites was present in hand spinning. The lack of uniformity will first be discussed.

The testimony shows that the more prevalent practice in hand spinning was to rotate the core manually and then rely on its momentum until the spinning operation was completed. Of course, without further acceleration the speed of rotation diminished and this destroyed the uniformity. This was particularly true when the hand stitcher was pressed with considerable force against the rotating core.

Defendant's witness, Walch, states (Vol. I, p. 289):

"x-Q. 34. While you were spinning down the fabric on the side of the core, under the hand spining method, did the core ever stop rotating?

A. Oh, yes; once in a while you would have to start it up again.

x-Q. 35. I suppose that depended to some extent on the speed that you originally gave to the core?

A. Yes, sir.

x-Q. 36. And I suppose also to some extent on the amount of pressure you applied to the side of the core?

A. Yes, sir."

Defendant's witness, Derry, testifies (Vol. I, p. 112):

"x-Q. 53. When you gave the core the highest velocity you could, did the speed die down toward the close of the operation?

A. Yes, sir.

x-Q. 54. Was it ever necessary to spin the core a second time because of its tendency to stop before the spinning operation was completed?

A. Yes. Run it down on one side, and had to give it a second whirl.

x-Q. 55. What I mean is this: There was a tendency, you say, for the rotating core to slow down?

A. Yes, sir.

x-Q. 56. Was it ever necessary to give the core an additional impulse, so as to enable you to complete the spinning operation on one side?
A. Yes."

Defendant's witness, Gregg, says (Vol. I, p. 152):

"x-Q. 52. I suppose that, if you pressed too hard, there would be a liability to slacken down the speed of the core, would there not?
A. Sure."

Defendant's witness, Duncan, testifies (Vol. I, p. 200):

"x-Q. 38. Did it ever happen that the initial momentum given the core in rotating it was not sufficient to keep the core rotating until the spinning operation was complete?
A. It may have. If it did, it was started again."

Another method of rotating the core was to accelerate it with one hand during the spinning operation, but obviously this introduced a new element of uncertainty in that it left only one hand to hold the stitcher. Several of defendant's witnesses testified to this practice, among whom may be mentioned Stark (Vol. I, pp. 129 and 130).

Core speed too low in hand spinning. [In order to make plaintiff's position clearer as to the present topic, it seems desirable to interpolate at this point the speed requirements necessary to secure the *State mode of operation, which involves as one element sufficient centrifugal force to throw the fabric skirts outward and to hold them around and in engagement with the advancing rolls,* as will be described more in detail later on. This centrifugal force is not manifest at all at a speed of less than 80 R. P. M. and it does not become effective until "somewhere between 80 R. P. M. and 120 R. P. M." Plaintiff's expert discusses this at several points, and the

matter seems of sufficient importance to warrant a rather extended quotation (Vol. I, p. 68):

> "x-Q. 95. Then is it your understanding of the language I have quoted from the disclaimer that the unapplied fabric is thrown out to a position substantially at right angles to the plane of the core by centrifugal force?
>
> A. I think this would be the case if the centrifugal force was being used to the best advantage. My observation is that the skirts are thrown at substantially right angles to the plane of the core when a 34 x 4 core is rotating at about 80 r. p. m., but at that speed the skirts are not smooth, but still present waves or corrugations. These waves or corrugations disappear, however, at a higher speed, such as that employed in the Goodyear commercial machines and the centrifugal force is then utilized to good advantage.
>
> x-Q. 96. You mean the thrown-out portions of the fabric will be smooth at a speed of about 120 to 150 r. p. m. Is that correct?
>
> A. They are smooth at that speed and become so somewhere between 80 r. p. m. and 120 r. p. m."

This proposition may be regarded as established for the purposes of this case. It is not disputed. It seems even to have been adopted by defendant. See for instance the testimony of defendant's expert near the top of page 219, Vol. I.]

Most of defendant's witnesses are unable to give the exact speed of the core. Some say it was as high as that of the core in present machines, but they mean the *original* speed of the core, and this necessarily subsequently diminished.

Defendant's witness, Walch, makes it clear (Vol. I, p. 292):

> "x-Q. 54. As I understand it, the speed of the core when you were spinning by hand depended on the way you originally spun the core?
>
> A. Yes, sir.

x-Q. 55. And of course that original speed of rotation grew less and less and less?

A. Yes.

x-Q. 56. Now, what did you mean in saying that you thought the speed of rotation at that time was practically the same as that of the Thropp machine now; do you mean that the original speed of the core was the same or the final speed?

A. When you would start it off; of course, it would die out a little. Of course, if you did not get both sides down, why you would have to start it up again."

Only one of defendant's witnesses, Roe, attempts to give the core speed in figures, and this testimony is particularly significant since Roe is a consulting engineer and a most intelligent witness. He testifies (Vol. I, p. 168):

"Q. 13. About how fast, if you know, were the cores rotated?

A. It would be hard to say, but I should judge from 50 to 60 revolutions per minute. It would average about that."

Accepting this average speed of 50 to 60 as a criterion, it is seen to be far below the minimum requirement of 80 to 120 previously mentioned. And it must be further borne in mind that this estimated speed did not refer to the first-mentioned practice, wherein the speed necessarily diminished, but to the other practice when the "core was caused to rotate by the left hand of the operator" (Vol. I, p. 167, Q. 11), and consequently there was no constant retardation. In other words, in the best possible circumstances, *there was no speed adequate to give the centrifugal effect necessary to produce radial stretch,* even though there may have been a rudimentary trace of it.

Roll pressure irregular in hand spinning.

In order to get proper results from the spinning method, there must be a considerable and certainly a uniform, pressure of the roll upon the core. This requirement is almost apparent, but defendant's witness, Roe, who is a mechanical engineer, specifically asserts it (Vol. I, p. 171):

> "x-Q. 45. Would you say generally that the amount of pressure employed in this Diamond spinning process was as great as that now applied in the several machines you have been discussing?
>
> A. Hardly. Not as uniform.
>
> x-Q. 46. In other words, you think that the pressure applied at the Diamond plant in the hand-spinning method was not only less than that now applied in the machine, and moreover was not uniform?
>
> A. Yes, sir.
>
> x-Q. 47. Do you think that, in this spiral mode of procedure that you have described, it is desirable to have the pressure on the stitcher uniform?
>
> A. I do."

In hand spinning the pressure of the roll could not possibly be uniform. It varied with the individual, with the strength and care and skill of the operator, with the method of application, etc. Some operators sat down; others stood up; some held the stitcher in two hands; others held it in one hand; some leaned the body against it; others held it at arm's length; some even used two stitchers, one in one hand and one in the other. Defendant's witness, Koplin (Vol. I, p. 97, x-Q. 47), held it in two hands and leaned his body against the handle. Defendant's witness, Drach (Vol. I, p. 100, Qs. 12 and 13), held it in both hands but away from his body. Defendant's witness, Derry (Vol. I, p. 113, x-Qs. 59 and 60), on one side of the core pressed his body against the stitcher and on the other side did not press his body against it. Defendant's witness, Heller (Vol. I, p. 122, x-Qs. 70 and

71), is unable even to estimate the pressure he applied, but (x-Q. 74) says that in the modern tire machine the pressure "is greater than a man could put on with his hand". Defendant's witness, Stark (Vol. I, p. 130, x-Q. 45), held the stitcher in one hand and turned the core with the other. Defendant's witness, Green (Vol. I, p. 137, x-Q. 21), sometimes held the stitcher in one hand and sometimes in two. Defendant's witness, Gregg (Vol. I, p. 152, x-Q. 51), is unable to estimate the degree of pressure. Defendant's witness, Roe (Vol. I, p. 171, x-Q. 44), states that some operators pressed the stitcher against the core with greater force than others. Defendant's witness, Duncan (Vol. I, p. 195, Q. 7), states that the workmen would sometimes hold a roller in each hand for application to opposite sides of the core; and (Vol. I, p. 200, x-Qs. 42 to 44) that the pressure would vary from twenty-five to one hundred and fifty pounds "according to how tired the man was"; and that he would probably be unable to exert as much pressure at the end of the day as in the morning, and (Vol. I, p. 201, x-Q. 47) that at the end of the day he would be tired and "all in"; and (x-Q. 51) that he held the roller at the end of his arm with the arm crooked.

Defendant's witness, Walch (Vol. I, p. 286, Q. 8), held the stitcher in two hands, and says (Vol. I, p. 290, x-Q. 42) that the pressure was very light and did not amount to anything, in direct opposition to Duncan's statement that it varied from twenty-five to one hundred fifty pounds.

What possibility was there in these variant practices of attaining the uniformity of roll pressure, which Roe testifies is so desirable, and which was ultimately secured in the perfected machine? State says in his patent that the work of his spring-pressed rolls (p. 5, line 119) "is far more even and rapid than in the case of a roll pressed against the core by one hand".

Other defects of hand spinning. Due to the uncertain pressure of the roll, the angle at which it was held, the difficulty in holding it firmly, the fatigue of the operator, and the general human equation, the roll would often slip or jump, resulting in imperfect and irregular laying of the skirts on the core, and often also in the scoring or abrasion of the fabric.

Defendant's witness, Walch, states (Vol. I, p. 290):

> "X-Q. 38. I suppose if you applied a higher degree of pressure there was a liability that the stitcher would slip?
>
> A. Yes; you had to gauge your stitcher; that is, guide it very good."

Defendant's witness, Heller, testifies (Vol. I, p. 123):

> "X-Q. 78. When you were holding the stitcher up against the tire, was there any tendency for the stitcher to jump away from the core when it encountered a splice? I mean, of course, in the hand-spinning operation?
>
> A. Yes; that's why I generally used both hands to hold the stitcher and let it rest against the shoulder, so as to hold it steady.
>
> X-Q. 79. When this happened, did you always succeed in getting the stitcher back to the exact same line that it was following before it struck the splice?
>
> A. Generally go back up to the top and down over again.
>
> X-Q. 80. In other words, it was difficult to hold the stitcher in proper relation to the core; and, when you struck a splice and the stitcher jumped away from the tire, the easier way was to begin the spinning operation over again; is that what you mean to say?
>
> A. Yes, sir."

Naturally these difficulties were intensified when the operator was "tired" or "all in", as Duncan said was the case. The liability to jump was done away with by State.

He testifies to this effect (Vol. I, p. 372, x-Q. 659 *et seq.*), as does plaintiff's expert (Vol. I, p. 78, x-Qs. 124 and 125).

Moreover, in this type of machine, both plaintiff's and defendant's, the work is made considerably easier for the operator. Defendant's witness, Curtis, testifies (Vol. I, p. 299):

> "x-Q. 63. I suppose making tires by a machine such as the Thropp machine is considerably easier for the operator, is it not, than making them by hand?
>
> A. It is easier and much faster.
>
> x-Q. 64. What I particularly had in mind was that it does not fatigue the operator to the same extent, does it?
>
> A. No; it does not.
>
> x-Q. 65. In other words there is less exertion?
>
> A. Yes."

Tire quality poor with hand spinning. In view of the fact that the hand spinning system was quicker, cheaper, and simpler, there could be only one reason for prohibiting it and finally abandoning it altogether, and substituting the slower, dearer, and more complicated sawtooth method, viz., that the quality of the product was poor. This is admitted by several of defendant's witnesses.

Defendant's witness, Drach, testifies (Vol. I, p. 102):

> "x-Q. 32. At what time?
>
> A. Well, about the time I was ready to leave the employment, they changed. The tires wasn't coming what they should be. They had a new system there then, changed the system; and I left for outside work."

He says (x-Q. 33) that there were air pockets.

Defendant's witness, Bittaker (Vol. I, p. 181, x-Q. 58) says that the Diamond authorities regarded hand spin-

ning as detrimental because they thought "that the threads which composed the fabric could not be kept at a 45-degree angle".

Defendant's witness, Koplin, states (Vol. I, p. 95, x-Qs. 25, 26) that it required skill and experience to prevent "wrinkling". Defendant's witness, Heller (Vol. I, p. 119, x-Qs. 46, 47), testifies in effect that there was too much fabric to be formed by hand, particularly in the larger sizes.

Defendant's witness, Derry (Vol. I, p. 113, x-Qs. 65, 66), affirms this. So does defendant's witness, Gregg (Vol. I, p. 150, x-Qs. 39 to 41), and he also refers to "wrinkling". Etc., etc.

There were also other reasons for the poor results, as to which argument is superfluous in view of the admitted facts. All of these faults have been corrected by State, and quite irrespective of whether the tire be large or small, by the introduction of adequate radial stretch and his other improvements and changes.

The Court of Appeals for the Third Circuit on Hand Spinning. Judge Buffington, in summarizing the defects of hand spinning, stated as follows:

> "This hand work required high skill and was physically hard on the operator. The core had to be actuated by one hand and the spinning roll directed by the other. Where the different layers of fabric overlapped, the roll was apt to jump. The initial speed of the core could not be maintained unless one hand of the tire maker was employed in revolving it and if one hand was so employed its non-use on the spinning roll of course made the roll jumping trouble more acute. Moreover, the variation in speed caused corresponding variation in the regularity and uniformity of the interstices of the fibrous material, and the output was limited to the strength and skill of the operator."

Unsuccessful Attempt to Embody Spinning in a Machine.

Still another indication of the difficulties inherent in the hand spinning method is provided by defendant's witness, Gregg. In an endeavor to improve it (Vol. I, p. 148, Qs. 18 to 25) he employed a power-driven core for a time, but it was a mere *experiment*. He selects that term himself in describing his efforts (Vol. I, p. 150, X-Q. 35). He says (Vol. I, p. 149, Q. 26) that he was at it "about a month", after which he abandoned the scheme and returned to the ordinary hand method (Vol. I, p. 151):

> "X-Q. 49. You say you worked on it about thirty days, to the best of your recollection?
>
> A. About that.
>
> X-Q. 50. And then what line of work did you take up?
>
> A. I went back to build the ordinary way, customary."

Even if the scheme had been a success, it could have no anticipatory effect for the reason that the date was not proved. Gregg admits he is unable to fix the time:

> "X-Q. 47. What was the exact date, for instance, when you worked on this experiment with the belt-driven core?
>
> A. I wouldn't attempt to give you the exact date.
>
> X-Q. 48. Well, can you give the year?
>
> A. Not positively."

The only other witness on this point is Bittaker, and he breaks down entirely on cross-examination, which it seems unnecessary to review beyond stating that he gives three distinct and conflicting dates for Gregg's experiment.

While the testimony is worthless to defendant, from a different viewpoint it is valuable to plaintiff. Gregg experimented and failed. State persisted and succeeded. Courts have frequently held that fruitless efforts of this description indicate that the final successful development by another must have been difficult of attainment.

Expanded Metal Co. v. *Bradford*, 214 U. S. 366 (381):

> "It may be safely said that if those skilled in the mechanical arts are working in a given field, and have failed, after repeated efforts, to discover a certain new and useful improvement, that he who first makes the discovery has done more than make the obvious improvement which would suggest itself to a mechanic skilled in the art, and is entitled to protection as an inventor."

Agawam v. *Jordan*, 74 U. S. 583:

> "The settled rule of law is, that whoever first perfects a machine is entitled to the patent, and is the real inventor, although others may have previously had the idea and made some experiments towards putting it in practice."

The Development of the State Machine.

This matter was not touched upon in the *Firestone* case. It is presented for the first time and to rebut defendant's hand spinning evidence. It was not reviewed nor even mentioned in Judge Bodine's opinion in the trial Court. The Court of Appeals below, however, recognized the importance of State's development work and, after finding that the machine was directed to a true combination of elements, stated as follows:

> "And not only is this conclusion the inevitable sequence of a clear understanding of the process, but the question of aggregation and combination is strikingly solved, and practically answered by a study of the evolutionary processes or stages by which through some fifteen different steps the patentee

gradually evolved in the tire-building art, the successful co-relation and adaptation of well-known hand operations to machine operations. The problem was one of great difficulty. It was not solved even by a single inventive thought or by its initial conception, but with the settled purpose in view of substituting machinery for hand work and automatic machine control for human skill.

State went through a most unusual series of experiments, and as each one was made it disclosed some difficulty which he had to overcome and did overcome step by step until at last he evolved a structure which did by rapid machine work, and largely by automatic operation, what was previously solely and laboriously done by exhaustive hand work. That the result was novel, is established by proof. That it was useful is shown by its prompt and general adoption as well as by the vast aggregate of its product, and that it was inventive is demonstrated not only by its own facts but it is evidenced by the cases decided by many different judges in this judicial circuit, who have from time to time carefully followed a clear controlling principle in dealing with the question of aggregation or combination in machines."

It should be remembered that the question of State's originality is not before the Court. *Prima facie* proof of that is afforded by the issue of his patent, and that stands. Defendant in its answer denied originality and attributed the invention to other named individuals, but the defense was afterwards dropped and no proofs were advanced to support it.

Here was the situation that faced State when he began his experiments. Goodyear practice demanded a tire possessing *uniform tension* and *this was possible solely by the use of the double stretch system.* The only way the result had been previously obtained was by the saw-tooth method. The effort to embody that method in mechanism had signally failed, that is to say, so far as

the conforming of the skirts of the fabric to the core was concerned. The Seiberling & Stevens machine had developed fabric supply means and also tension devices to give the circumferential stretch, but the jigger fingers relied on to impart the radial stretch to the sides of the tire were ineffective. The situation was discouraging. The only thing open to State was the hand spinning method, and this was full of imperfections, and in addition was incapable of producing adequate radial stretch, which, if present at all, was merely as a rudimentary trace.

In the preceding sections has been given a statement of the defects in hand spinning and this statement is based on the admissions of its friends and sponsors, not upon the testimony of inimical critics.

The case seemed almost hopeless, but nevertheless State took it up and worked at it for months. His apparent lack of progress at times was disappointing but he persevered. In the course of the work he devised a considerable number of different embodiments, each to be superseded by another, until success finally came. He backed and filled, advanced and retreated, but at last turned out one of the most remarkable commercial machines of modern times,—one which not only eradicated the faults and defects of the hand spinning method, but which also produced uniform tires having balanced circumferential and radial tension quite irrespective of whether they were large or small. As this Court said in *Diamond Rubber Co.* v. *Consol. Rubber Co.*, 220 U. S. 428 (435):

> "Nor does it detract from its merits that it is the result of experiment, and not the instant and perfect product of inventive power."

In other words, he converted a defective hand method and a poor product into a perfected commercial machine

and a high-grade product. The Courts have always looked with favor upon such achievements. The leading case, discussed hereafter, is *Hobbs* v. *Beach*, 180 U. S. 383, wherein this Court held invention in similar circumstances. The machine there involved and its product were extremely simple. When the product is complex, and therefore more difficult to make, the end attained is correspondingly more meritorious. This is one reason the structure of the tire carcass and the peculiar nature of its thread reticulations have been dwelt upon.

State's deposition. State, beginning with Q. 7 (Vol. I, p. 303), describes the Goodyear hand method, wherein the circumferential stretch was about twelve per cent., and proceeds (Q. 12) to describe the sawtooth operation. He points out (Qs. 15 *et seq.*) that this involves the double stretch system as distinguished from the single circumferential stretch plan, and says (Q. 20) that "it made a better, uniform, balanced tire", and for that reason (Q. 21) was regarded as superior to the single stretch method.

Then (Vol. I, p. 305, Qs. 22 to 35) he tells of the Goodyear endeavor to embody the sawtooth method in the Seiberling & Stevens machine, and testifies that the jigger fingers were unsuccessful. It should be noted (Qs. 34, 35) that he saw this machine operate and that the highest speed of the core therein was about 30 R.P.M. This is important as bearing out the claim that State produced the first high speed core ever used commercially. The Seiberling & Stevens machine (Qs. 36 *et seq.*) was junked and the Goodyear Company continued its old hand practice, and this condition continued for three and one-half years during which it was in financial difficulty.

State began his experiments (Vol. I, p. 307, Qs. 40 *et seq.*) early in 1907 and attained success the latter part of the same year, the machine being put into commercial

operation in the early part of 1908. These dates will probably not be disputed, but in any event they are fully corroborated. He says (Qs. 44 to 47) that it was his endeavor to embody in a machine the double stretch system previously in vogue at the Goodyear plant, and that as a matter of fact there was a general order that only this type of tire should be manufactured.

He testifies (Vol. I, p. 308, Qs. 48 to 56) that he learned of the hand spinning method, although it had never been used in the Goodyear plant and he had never seen it. He heard of it first from McDonald, and McDonald demonstrated and illustrated it for him as the basis of his experiments. State then begins to detail the course of his development (Q. 57 *et seq.*) and to make his story clearer, he produces a series of rough sketches, which have been introduced in evidence as Plaintiff's Exhibit No. 8 (Vol. 2, pp. 65-97). These sketches (Vol. I, p. 332, Qs. 233 to 236) were State's own idea, as he thought that they would make his testimony more intelligible than mere verbal description. It will be understood that they do not purport to give exact proportions, and that their sole purpose is to indicate what he did better than he could do it by words alone. The sketches are consecutively numbered, generally in the sequential order of the various devices, although perhaps not always in exact chronological order.

1st Device. This was a manually operated device (Vol. I, p. 310, Qs. 63 to 72), wherein the handle C could be used either in connection with the worm A to secure the initial circumferential stretch, or on the shaft D to spin the core, the endeavor being to use a slow speed for the original stretch and a higher speed for the spinning operation. Obviously, the core could be rotated faster by the handle than in the hand spinning system, perhaps 75 or 80 R. P. M., but the operation was unsuccessful.

He gives some of the reasons for this in his answer to Q. 68:

> "A. In using the hand tool, the hand spinning tool, it was hard to guide it. It would jump in and wrinkle the fabric. It didn't seem possible for it to hold it steady enough. You couldn't gauge the advance of the stitcher, you couldn't control it; it jumped. It wouldn't stitch it down even. It would lead in just like a thread. You would miss a lot of the fabric and not roll it down. His hand off, and come in contact with the fabric; holding it with two hands, and would throw a lot of wrinkles in it, in the edge of it."

In addition, the roll jumped at the splice, there was no "appreciable degree of radial stretch", and no sufficiently high speed of rotation to obtain the necessary centrifugal force. It should be noted how accurately this experience corresponds with that related by defendant's witnesses. These first tires were bad. In this arrangement, to procure the original circumferential stretch, the fabric was held and retarded by the hands of the operator, and State next attempted to do away with that necessity.

2nd Device. In this form (Vol. I, p. 311, Qs. 73 to 76) he added another stand to carry the roll of fabric, and used a brake and weights to obtain the necessary resistance for the initial circumferential stretch, but there was no change in the manner of working down the skirts of the fabric. The tires thus produced (Vol. I, p. 342) were not good nor commercial, being badly wrinkled and requiring a large amount of hand work to patch them up.

3rd Device. Here (Vol. I, p. 312, Qs. 77 to 83) State starts in an endeavor to obviate the difficulties inhering in the spinning operation. Because of the trouble involved in holding the stitcher firmly he devised the horseshoe plate or rest R, shaped so that it would surround the edge

of the core, and on which the operator could rest his hand and thus steady the tool, but (Q. 81) he was still unable to get the requisite amount of radial stretch. He also devised a special form of stitcher with a spring inserted between the roller and the handle, so that it could be held against the fabric more satisfactorily and would not jump. The tires were still bad (Vol. I, p. 344), and the few that were taken out were "torn down and rebuilt by hand". In addition, the fabric was badly scored.

4th Device. This (Vol. I, p. 313, Qs. 84 to 91) is the first instance of the core being driven by power, his idea being (Q. 87 *et seq.*) "to get a higher speed than a man could do it by a crank" so as to obtain greater centrifugal force and *lessen the wrinkling.* This was attempted by the use of a belt from the line shafting. However, the effort was unsuccessful and the tires were still bad (Vol. I, p. 344, x-Q. 373). Most of them were torn apart and the remainder patched up.

5th Device. The previous driving means being unsuccessful (Vol. I, p. 314, Qs. 92 to 98), State next attempted to employ an electric motor, its speeds being varied by a rheostat, but again the effort failed. The speed range (Vol. I, p. 346, x-Qs. 382, 383) was from 70 to 85, but (x-Q. 385) the tires were still very poor. It will be noted that State was approximating the necessary speed but had not yet obtained it, and in addition, he was still employing the spring stitcher and the horseshoe rest.

6th Device. Here (Vol. I, p. 314, Qs. 99 to 103) his improvement related to the fabric supply means, the principal addition being a second roll of fabric which could be used when desired. The tires (Vol. I, p. 340, x-Q. 405) were "no better". The speed was the same as in the previous devices, and as already pointed out, not yet sufficient.

Sketch 7. This apparatus marks an advance involving the abandonment of the hand stitcher. It was not successful but was a step in the dight direction. He employed an additional stand R supporting an adjustable bar or rest, and also a pair of tongs S to carry the rolls, as best shown in the smaller figure. These tongs were operated by hand and rested on the bar. In this way, State hoped to give the necessary pressure on the fabric, advance the rolls with some degree of regularity, and also operate on both sides of the core simultaneously, but again he was disappointed. "The tongs would tip and cut into the fabric, and wrinkled it, and were very hard to hold" (Vol. I, p. 316, Q. 112). In this apparatus State also managed to get a little higher speed (Vol. I, p. 350, x-Qs. 432, 433), up to 90 or 95. This he did by changing the pulley diameters on the motor. Notwithstanding the fact that he was raising the speed, it was still not adequate, and in addition the tong arrangement did not work satisfactorily. The tires (Vol. I, p. 351, x-Q. 443) were still "very poor".

Sketch 7a. Next (Vol. I, p. 316, Qs. 115 to 123) State increased the fabric supply so that he had four rolls available. In addition, he employed for the first time a *speed change mechanism*, a low speed for circumferential stretch, and a high speed to rotate the core rapidly. This two-speed mechanism is substantially equivalent to that shown in his patent and embodied in his commercial machine, although there improved and refined. He says (Q. 123) that prior to his experience he had never "seen or known of a high-speed core". He is not certain just what the speeds were, but endeavors to estimate them (Vol. I, p. 351, x-Q. 45) at 10 or 12, and 85 or 90, respectively, although he says (Vol. I, p. 353, x-Qs. 462, 463) that the high speed may have been "about a hundred" and the low speed 9 or 10. However, he made no tires at this

time (Vol. I, p. 352, x-Qs. 455, 456) as he was "just working out speeds"; there were no side forming devices; later on he made tires, with the apparatus as shown in the next sketch.

Sketch 7b. This apparatus (Vol. I, p. 318, Qs. 124 to 135) is substantially the same as that last referred to, but adds a different means for supporting the tongs first shown in Sketch 7. He substituted for the rest, a movable table or slide on which the tongs were mounted. This slide is shown at M and its movement was effected and controlled by the lever W. He again encountered difficulty (Q. 134) because "the contact of the rolls with the side of the core tended to pull the slide in" and (Q. 135) he could not "get a uniform advance of the rolls". This step is of interest in that such a slide was employed in the completed machine, although with totally different operating and controlling means, as will presently appear. The speed (Vol. I, p. 356, x-Q. 499) was about 95. The general evolution is apparent. He had worked up almost to the required high speed of core rotation, and moreover, was having somewhat better results in the control of the rolls. This becomes further apparent from the fact that although (x-Q. 498) the tires made thereon were not "salable and usable", nevertheless (Vol. I, p. 355, x-Q. 489) they "were just beginning to get a little better".

Sketch 8. Here (Vol. I, p. 319, Qs. 136 to 144) was another step in advance, and an important one. He still used the slide M and the tongs mounted thereon, but in order to overcome the troubles involved in the use of the controlling lever W, and to secure a uniform advance of the slide, he substituted for it a screw, which had two functions (Q. 139), since it enabled the operator to advance and retract the slide at will, and moreover resisted the tendency of the rolls to pull the slide in. In addition,

the tongs were provided with a spring S (Q. 141) whereby the rolls were forced together by a yielding or spring action. Also, he employed a wheel H and handle X to turn the screw, the wheel being formed with several holes (Q. 143) so as to control the hand operation of the screw in relation to the speed and regularity of advance. It is noted that this screw arrangement was embodied in the final commercial machine, although there was still a considerable degree of alteration necessary in connection with it. A few tires (Vol. I, p. 359, x-Qs. 526, 527) were made on this machine of about the same quality as those on the preceding apparatus.

Sketch 9. This stage marks the abandonment of the tongs, and (Vol. I, p. 321) there appears in it for the first time the two distinct stitcher arms separately pivoted on the slide and each provided with a spring, in a manner somewhat approximating the final arrangement. Another point of interest is that each of the arms was formed with a control handle whereby the operator could either augment or diminish the pressure, also as contained in the final machine. However, there was much to be done yet in connection with these elements. The arms were not properly shaped, nor properly located, and the flat springs were not efficient. The high speed (Vol. I, p. 359, x-Q. 532) State estimates at 110, 112, 115, and the tires (x-Q. 529) "were getting better on that machine; better tires made on that than the previous ones". Progress was being made now, although still slowly.

Sketch 10. There are several changes here (Vol. I, p. 322). For instance, the inefficient flat springs of the previous form were dropped and in place thereof the arms were experimentally connected by a single spiral spring located in advance of the pivot. As will be seen, this arrangement was not finally adopted. Perhaps the

principal point in this stage was the provision of a new form of slide, it having two parts M and M^1, the latter being mounted upon the former and connected thereto by adjusting screws, so that the position of the table proper M^1 could be varied to locate the rolls at different heights. The vertical position of the rolls in reference to the core proved to be most important. For instance, if they were too low there was a tendency to wrinkling, and (Q. 153) there "was a lot of experiment on it", at least several days (Vol. I, p. 361, x-Q. 545); and (Vol. I, p. 322, Q. 151) "the final adjustment as to height was a fraction above the center". He experimented also to find the proper direction of rotation (Vol. I, p. 377, x-Qs. 710, 711). The speed (Vol. I, p. 359, x-Q. 533) was "about 110 or 115". The tires (Vol. I, p. 360, x-Q. 536) "showed up fairly well". "They would have been salable tires; but they used them on tests" (x-Q. 537). Here is evidence of encouraging progress.

Sketch 11. The principal change here (Vol. I, p. 323, Qs. 159 to 165) was in the arrangement of the stitcher arms, which were made shorter and mounted further forward on the slide, and each provided with a flat spring, reverting in that respect to the arrangement of Sketch 9. Perhaps there was nothing revolutionary in this, but it showed the necessity for continued experiment and alteration. As State says (Vol. I, p. 361, x-Qs. 551, 552), the coil spring inside the arms not only did not give the proper pressure, but even contacted with the tread of the tire. Tires were made (Vol. I, p. 362, x-Qs. 556 to 558) on this machine, "were finished and tested, and proved good".

Sketch 12. Again (Vol. I, p. 323, Qs. 165 to 169) the flat springs on the stitcher arms proved ineffective, and therefore another arrangement was tried, namely, a spiral compression spring for each of the arms at the

outside thereof. The previous flat springs were not sufficiently adaptable about the core and "were continually breaking" and getting set. Also, there was a reversion in the shape of the stitcher arms. The best combination was hard to determine. The tires (Vol. I, p. 364, x-Q. 577) were "pretty fair tires". They required (Vol. I, p. 365, x-Q. 585) some hand work but "were getting better".

Sketch 13. Here we find the table with the several tools thereon, much as shown in the patent. This arrangement, while perhaps desirable in the commercial machine, does not interest us particularly, as substantially the only thing involved in this case is the correlative action of the forming rolls and the rotating core. It is interesting to note that again State uses flat springs for the stitcher arms. As he explains (Vol. I, p. 365, x-Qs. 586 to 591), he was "experimenting back and forth", and while the spiral springs of Sketch 12 were better than the leaf-springs, he concluded to go back and test the leaf-springs over again. This indicates the large amount of detail and testing that was necessary even in the adaptation of minor parts.

Sketch 14. This sheet (Vol. I, p. 324, Qs. 174 to 179) is of similar import and shows the various forms of screws State experimented with before he obtained the right one. As he explains, he tried both screws with square threads and screws with V-threads. Also, it was necessary to cover the surface completely and evenly and this involved determining the exact pitch. As explained by the experts, if the distance between the convolutions of the spirals be too great, the fabric will not be properly applied (Vol. I, p. 79, x-Q. 158). On the other hand, this distance should not be too small. State did not get the desired result until he had made four different attempts with four different kinds of screws.

Sketch 15. This sheet (Vol. I, p. 325, Qs. 180 to 182) shows the different forms of rolls State tried out before he found the right one. A too sharp edge would cut the fabric and he experimented with five of them and finally selected a large wheel with a blunt edge. This point is mentioned in the State specification. The cross-examination (Vol. I, p. 368, x-Qs. 619 to 655) clarifies the difficulties of State in this respect, although too long to be referred to here more than generally.

Other difficulties. In addition to the problems indicated by his sketches, State testifies as to other troubles. Perhaps some of them, considered individually, do not suggest invention, but collectively they added to his perplexity. For instance (Vol. I, p. 326, Qs. 183 to 186), the stitcher wheels had plain bearings, and during his experiments these bearings would grind out and the rolls be thrown off. He could not lubricate them, and so in the final machine he devised a form of stitcher with ball bearings. He explains (Vol. I, p. 378, x-Qs. 718 *et seq.*) that while plain bearings were used in the hand spinning operation, they became worthless when a core speed of 120 R. P. M. was attained. Of course, they would work, but they were quickly ruined.

Again (Vol. I, p. 326, Qs. 187 to 191), he had considerable difficulty in arranging the roll at the proper angle; it was necessary to press the fabric against the side of the core and also to provide sufficient frictional engagement to get the radial stretch; but on the other hand it was necessary so to locate it that the outflung skirt would not become entangled with it. After some experiment (Vol. I, p. 379, x-Qs. 726 to 735), he located the roll at a receding angle, as described in his specification and claims.

His experience in connection with his first hand spinning experiments was in line with those testified to

by defendant's witnesses (Vol. I, p. 327, Qs. 192 to 195). The skirt became entangled with the hand; it was impossible to advance the roll regularly; the advance was spasmodic; he got very little radial stretch. *All this was intensified* when the core ran at a speed higher than that of the hand operation. State testifies (Vol. I, p. 372, x-Qs. 659 *et seq.*) that the tendency of the roll to jump was materially diminished as his machine progressed, because of the better mechanical control.

Double stretch. State testifies (Vol. I, p. 307, Qs. 44, 45) that in his machine he embodied the Goodyear system of combined circumferential and radial stretch, the percentage of the former (Vol. I, p. 328, Qs. 197 etc.) being about twelve per cent. at the tread, and that of the latter as high as fifteen per cent. at the bead. This percentage of radial stretch (Vol. I, p. 380, x-Qs. 736 to 738) was determined by actual measurement. Seiberling confirms this completely (Vol. I, p. 395, Qs. 59 to 61, and Vol. I, p. 400, x-Qs. 104 to 111.

State's Assistants. In the course of his work, State was assisted by several subordinates, among whom were McDonald, Thomas, McBride, and Wattleworth. For instance, Wattleworth was a designer and draftsman and worked out some of State's ideas for him, as for example, the precise forms of springs, of screws, etc. Because of this cooperation of State's subordinates, defendant argues at length that there is evidence of joint inventorship and consequently the patent is void. However, there is absolutely no foundation for the contention. The *only* evidence in the record is that of State himself. For instance (Vol. I, p. 384):

> "Rd-Q. 773. Did Mr. Wattleworth, in connection with your experimental work, operate under your direction?
>
> A. He did.

Rd-Q. 774. Was his general mode of operation to work out suggestions made to him by you?

A. They were.

Rd-Q. 775. For instance, and purely by way of example, in connection with the screws that you used to advance the slide, did you suggest the use of a screw to him, and leave it to him to work out the proper form?

A. I did."

No witness but State testified on the subject, and it is further to be remembered that, as already pointed out, the question of State's originality does not arise at all, since defendant made no effort to overcome the *prima facie* presumption contained in the issue of the patent in suit.

What State did is the customary practice and one approved by the Courts. This Court has said:

Agawam vs. *Jordan*, 74 U. S. 583:

"* * * where a person has discovered an improved principle in a machine, manufacture, or composition of matter, and employs other persons to assist him in carrying out that principle, and they in the course of experiments arising from that employment, make valuable discoveries ancillary to the plan and preconceived design of the employer, such suggested improvements are in general to be regarded as the property of the party who discovered the original improved principle, and may be embodied in his patent as a part of his invention."

This general statement of the law is much broader than necessary to cover the conditions appearing in the present record, but reference is made to the particular authority for the reason that it is a leading case and is frequently cited and relied on. See, for instance, the recent opinion of this Court in *Mineral Separations* vs. *Hyde*, 242 U. S. 261.

Moreover, the particular features cited by defendant in connection with this contention were early *experimental* forms, all of which were abandoned in the last and commercial embodiment, such for instance as the belt drive of the 4th device, the tongs S of sketch 7, the pivotal arrangement of the arms of sketch 9, the first form of screw of sketch 8, and the slide of sketch 7^b. In other words, four or five draftsmen and mechanics, who were helping State, worked out at his direction the specific details of some of the individual parts in the course of his experiments, and all of them were superseded again and again by other experimental parts before the work was finally completed.

State's dates. These dates are clearly fixed and will probably not be disputed. State says (Vol. I, p. 307, Qs. 40, 43) that he started his experiments in 1907, and that a machine was first used for making tire carcasses the latter part of that year, and was put into commercial practice in the spring of 1908. This is corroborated in many ways. Seiberling says (Vol. I, p. 388, Qs. 17 *et seq.*) that State began in 1907, and he refreshes his recollection by the letter he wrote to his brother from Milan (Vol. I, p. 401) of August 12, 1907. He then wrote what he had heard of the Vincent machine and his brother replied by cable to the effect that State was making excellent progress (Vol. I, p. 403, x-Qs. 116, 118). Seiberling also testifies (Vol. I, p. 389, Q. 31) that the machine was operated experimentally in the fall of 1907 and put into the factory in the spring of 1908.

Such an outstanding and important date really requires no extensive corroboration, but the factory ledger (Vol. I, p. 389, Q. 32) shows that the first machine, No. 261, was completed and the order "closed out" April 30, 1910. Again (Vol. I, p. 390, Qs. 33 to 35) Seiberling refreshes his recollection by a letter to his brother, of May

1, 1908, in which he refers to the very satisfactory operation of the machine. There is more to the same effect. A bit of corroboration is found even in the testimony of one of defendant's witnesses. Derry (Vol. I, p. 109, x-Q. 20) said that he was employed at the Goodyear plant "the time they installed that new machine. I saw the first tire put up on that machine." The Goodyear records show (Vol. I, p. 399, x-Q. 103) that Derry's term of employment was from April 13, 1908, to August 5, 1908. In addition, the working drawings for the first machine carry various dates, such as December, 1907, January, 1908, etc. It may be noted generally at this point that an extremely protracted and searching cross-examination failed to shake State's testimony in any important particular.

State's work completed. State testifies (Vol. I, p. 331, Qs. 223 to 229) that after the experimental work was completed in the fall of 1907, he turned the work over to the designer and draftsman. He supervised the drawings in a general way but did not get down to the details. He gave only attention enough to determine that his ideas were being carried into the machine. These working drawings were put in evidence *by defendant* and appear as Defendant's Exhibit X. State was the inventor. When the invention was complete he was through. It was then turned over to others.

First commercial machine. The original machine employed commercially by the Goodyear Company, No. 261, is in evidence as Plaintiff's Exhibit No. 2, but will not be produced in Court. It weighs six tons or more and is in a storage warehouse. Its production is unnecessary, as defendant's expert admits, after having examined it (Vol. I, p. 281, Q. 70), that it "in general form and arrangement was similar to that shown in the State patent, the only notable differences being in the

gearing". As will be subsequently shown, the specific difference is immaterial. For purposes of convenience, plaintiff exhibited in the Court of Appeals below a reduced model, Plaintiff's Exhibit No. 29, Model of State Machine, and also certain photographs, Plaintiff's Exhibit No. 35, Photographs of State Machine, which show practically the same thing.

The machine itself was an exhibit in the earlier litigation and Seiberling testifies (Vol. I, p. 394, Qs. 50 to 56) that it is now in "the same condition as when first constructed and used", and that it was set up and put in operation in precisely the same shape as it was used in the plant. Apparently some improvements were added to this first machine, but he (Vol. I, p. 409, x-Q. 173) had the necessary changes made "in that machine before it was put in evidence in Cleveland, in order to return it to its original condition". There is strong corroboration that it was perfectly restored in the admission of defendant's expert, who says it is substantially the same as the machine of the patent except in the matter of gearing, and even in that minor respect it can be shown that the gearing corresponds to that of the original working drawing, this statement being also based in large part on the admissions of defendant's expert.

Defendant's counsel called for a demonstration of this machine and gave notice of application for an order to that effect, but he waived it, as no such application was ever made. As explained at the time (Vol. I, p. 502), the demonstration was not given because of the existing war conditions. Not only was it extremely difficult to get suitable space in New York, but in addition numerous efforts to get the proper electric power were failures. It was long after defendant's testimony was closed that the necessary power was obtained (Vol. I, p. 584, x-Q. 248). At the time of counsel's notice, the machine had already been dismantled and placed in the storage warehouse,

where it still remains. Moreover, defendant's counsel and expert were given ample opportunity to observe the operation of other Goodyear machines which the evidence shows are like Plaintiff's Exhibit No. 2, and they had actually seen the exhibit machine, although not in operation.

As already mentioned, that particular machine had been successful from the start, and over 150,000 tires were made upon it before it was put in evidence in the earlier litigation. Browne (Vol. I, p. 458, Qs. 38 to 40) testifies that he had seen the machine operated satisfactorily, and at a higher speed than the one given as an example in the State specification. Ray (Vol. I, p. 542, Q. 68) speaks of the tires made upon this exhibit, at a later period when the power was obtained. But ignoring all this cumulative evidence as to the successful operation of the exhibit machine, the only possible point involved might be to demonstrate some deficiency, and this is immaterial. A first machine never works as well as later ones in the light of experience. The Courts have held this many times.*

Original commercial speed. The original speed of the core was quite high and was subsequently reduced as a result of experience and experiment. State explains (Vol. I, p. 330, Qs. 212 to 216) that the rapid speed at the outset arose from the conditions under which he was working, namely, in a close attic in the summer

* This Court, in *Hildreth* vs. *Mastoras*, 257 U. S. 27, stated as follows:

> "It is not necessary, in order to sustain a generic patent, to show that the device is a commercial success. The machine patented may be imperfect in its operation, but if it embodies the generic principle and works, that is, if it actually and mechanically performs, though only in a crude way, the important function by which it makes the substantial change claimed for it in the art, it is enough. (*Telephone Cases*, 126 U. S., 1,535; *Mergenthaler Linotype Co.* vs. *Press Publishing Company*, 57 Fed. Rep., 502, 505)."

time, where the heat dried and stiffened the fabric, thus necessitating greater speeds to obtain sufficient centrifugal force. It was subsequently learned that such high speed was not necessary when the fabric could be kept in soft and pliable condition.

Defendant's counsel devoted much effort to obtaining statements from State and Seiberling as to the high speed of this original machine No. 261, but both of them refused to guess at it. As already pointed out, State finished his work when he turned it over to the designer and then these matters were attended to by others. He distinctly says (Vol. I, p. 376, x-Qs. 697 to 699) that he did not determine and was not the one to decide upon the high speed. The conditions were substantially the same with Seiberling, who was the principal executive of the Company and not in touch with all the details of construction and development. Seiberling does say that there were experiments with and changes in the speed to get the best commercial results, but he cannot state them, nor the dates when they were made. In any event, the best evidence is the machine itself, which was inspected by defendant's expert. This high speed was 230 R. P. M.

The probable explanation of the matter is that when State was getting better results all the time by increasing the speed, the construction department did not see there was a limit to this advantage and therefore gave the first machine speed of 230 R. P. M. It was perfectly operative at this rate, but other disadvantages crept in. State says in substance that at too high speeds (Vol. I, p. 329, Qs. 206 to 211) it took too much time to overcome the inertia and speed up the heavy core. And likewise it took too long to check the momentum, and they were compelled to use a brake for that purpose. He also says that these high speeds involved a heavy strain on the gearing. Therefore, it was concluded to diminish the speed. By way of illustration, the speed mentioned in the patent is 207

R. P. M. This was apparently an arbitrary cut of ten per cent. from the original 230 R. P. M. Later on, the speed was still further reduced and the Goodyear rate at the present day is between 120 R. P. M. and 150 R. P. M. (Vol. I, p. 55, x-Q. 36), experience having demonstrated that with a range of this extent the full advantages of centrifugal force are obtained with a minimum of the disadvantages mentioned by State. This corresponds closely also to the *desiderata* given by plaintiff's expert.

There is no requirement of law that the very best mode of operating a machine should be stated in the patent. That is invariably determined by experience. Under the authorities, if the patent gives a workable method, it is adequate. Seiberling testifies (Vol. I, p. 394, Qs. 57, 58) that 150,000 tires were built upon the first machine, which seems a fair criterion of practicability.

Alleged defects in rolls. Defendant's counsel seemed to be curious as to whether or not the angularly arranged rolls were capable of tucking the fabric about the bead. As to this, Seiberling testifies (Vol. I, p. 396, Qs. 74 to 76) that in the earlier days the rolls were used in the manner indicated, but later on a separate tool was employed. This was obviously because (Vol. I, p. 397, Qs. 82, 83) the earlier tires were clincher tires and later on more straight-side tires were made. He affirms this at Vol. I, p. 409, x-Qs. 181 to 183. Ray testifies (Vol. I, p. 543, Qs. 70, 71) that the practice of laying the fabric around the beads by the rolls was still in vogue at the Goodyear plant at a time only shortly before he made his deposition. The whole matter is immaterial, since it does not affect the broad invention covered in the State patent.

Again, defendant's counsel apparently argues that springs for pressing the rolls are not as efficient as the weights used by defendant, and that hand pressure is also necessary. State says (Vol. I, p. 330, Qs. 217 to 220) that

the springs alone are adequate and that the hand control is an auxiliary refinement, although not always a necessary one, and he discusses the subject again more at length (Vol. I, p. 376, x-Qs. 700 to 709). Browne testifies (Vol. I, p. 74, x-Qs. 126, 127) that the regular practice he saw on the Goodyear machines is to rely on the springs alone without any supplemental pressure by the operator. But whether or not, the attempt to differentiate defendant's weights from State's springs is futile. Not only are weights and springs recognized mechanical equivalents, but State says so in his patent, and further adds that when he refers to springs he means to include weights also (patent, p. 5, line 125).

Commercial Success.

The authorities have held again and again that commercial success and extensive adoption are the best proofs of merit. Rarely are there found more impressive circumstances of this nature than in the present case. When invention is in doubt success tips the scale in its favor.*

The first machine was efficient from the beginning, as indicated by the fact that 150,000 tires were made on it. Seiberling testifies (Vol. I, p. 390, Qs. 36 *et seq.*) also as to the good quality of the tires. He refers (Vol. I, p. 397,

*_Krementz_ vs. _Cottle_, 148 U. S. 556:

"When the other facts in the case leave the question of invention in doubt, the fact that the device has gone into general use and has displaced other devices which had previously been employed for analogous uses, is sufficient to turn the scale in favor of the existence of invention."

Wm. R. Thropp & Sons Co. v. _DeLaski & Thropp Co._, 226 Fed. 941. In this case the Court said:

"The fact that the art presented problems and that the device of the patent solved them, as well as the fact that the device has gone into general use and has produced new and economical results, speaks for its inventive character. *Smith* v. *Goodyear Dental Vulcanite Co.*, 93 U. S. 486, 23 L. Ed. 952; *Magowan* v. *New York Belting Co.*, 141 U. S. 332, 343, 12 Sup. Ct. 71, 35 L. Ed. 781; *Potts* v. *Creager*, 155 U. S. 597, 609, 15 Sup. Ct. 194, 39 L. Ed. 275."

Qs. 84, 85) to the employment of the double stretch method, and to the production of the stronger carcass having more uniform tension. He says (Vol. I, p. 398, Qs. 86 to 90) that this type of machine in practically its original condition is still in use in the Goodyear factory, although a new and improved form is also being employed there. He says (Vol. I, p. 397, Qs. 77 to 81) that a man with the State machine can make ten times as many tires as by hand. It will be remembered also that the ease and comfort of the operator have been materially increased.

In addition to this (Vol. I, p. 390, Qs. 38 *et seq.*) the machine was subsequently duplicated and delivered to some *fifty* licensees, including such concerns as the United States Rubber Co. and the Fisk Rubber Co. The impressive list of these licensees practically fills pages 392 and 393 of Vol. I of the record, to which reference is directed. Only the desire to save space prevents its inclusion here. It should be noted also that the list includes only the American licensees and *not* the foreign ones.

Substantially the entire Goodyear output of fabric tires has been made upon machines of this type, to the number of twenty millions, and in addition thereto the named licensees have made another forty millions, or sixty millions in all (Vol. I, p. 391, Qs. 41 to 43). These figures (compiled several years ago) are conservative and believed to be an under-estimate, and, moreover, do not include tires made on defendant's infringing machines.

The Court is asked to consider this amazing production. Sixty million tires at an average retail price of $25 would aggregate a billion and a half of dollars,—a very respectable national debt in pre-war times!

And the licensees continue to use these machines notwithstanding the adverse decision in the sixth circuit. Under their contracts they had the privilege of abandoning their machines in such event, but only one of them (and that one the user of a single machine) took advan-

tage of the provision. The remainder either ignored it entirely, or else entered into a new arrangement with plaintiff whereby they pay half of the regular royalty outright, and deposit the other half in escrow to be turned over to plaintiff in the event of his ultimate success in reinstating the State patent (Vol. I, p. 391, Q. 47; p. 404, x-Qs. 132 to 136). Copies of these license agreements, which specifically refer to the present case, are in evidence as Plaintiff's Exhibit No. 16 (Vol. 2, pp. 143 to 146). They do *not* mention the Seiberling & Stevens patent, as defendant inadvertently states.

It even appears that a number of licenses have been sought and obtained *since* the unfavorable opinion in the sixth circuit. Among these new licensees are the ten concerns listed on page 627 of Vol. I. It would be difficult to find an indication of higher appreciation than this.

Four-fifths of the machines furnished to the licensees were substantially like State's first commercial machine, Plaintiff's Exhibit No. 2 (Vol. I, p. 405, x-Qs. 138, 139). And the new type referred to by Seiberling as in use in the Goodyear factory, and a small proportion of which have been delivered to licensees, are all provided with the same general combination of the State patent (Vol. I, p. 398, Qs. 91 to 93), although in connection with sundry improvements. For instance (Qs. 94 *et seq.*), air pressure instead of spring pressure is applied to the stitcher arms, as well as automatic means for releasing this pressure at the proper point; there are automatic means for separating the rolls; there is a pneumatic bead setter, an electric drive control, etc., etc. None of these additions affect the questions at bar. The proofs show (Vol. I, p. 412, Rd-Qs. 201, 202) that all of the elements covered by the State claims in suit are present in the machines furnished to the licensees. This is confirmed by Trogner (Vol. I, p. 620 *et seq.*), who details specifically the construction of these machines, and from whom

it appears that the only modifications (and some of these were subsequently dropped) need not be considered.

There are always alterations and supposed improvements in every successful apparatus. They will be found in defendant's machine as well as in the Goodyear machine. Authorities are abundant to the effect that improvement does not avert infringement.*

The Improved Product.

That State's tires were an improvement on the hand-spun variety is established beyond question. The record shows (1) that the hand-spun tires were poor for a variety of reasons, as by the previously discussed testimony of defendant's witnesses, Drach, Bittaker, Koplin, Heller, Derry, Gregg, etc.; (2) that State's tires were good, as by the testimony of Seiberling and State; and (3) that the reason for the difference was that the latter possessed the balanced tension of the double stretch system, arising from State's interjection of radial stretch. These three propositions cannot be disputed.

The *fact* of superiority being established, plaintiff has endeavored also to determine its *extent* and to express it mathematically in an approximate percentage. To this end two different sets of comparative tests were conducted, and although under totally different conditions, nevertheless with striking similarity in results.

These tests were made by Mr. Ray, who is a mechanical engineer and machine designer and had devoted much time to the study of tires and tire-making. They were made both for the purpose of determining the degree of

* Walker on Patents, 5 Ed., p. 463, states as a general rule that "a defendant's machine may be better than that covered by the patent in suit and may be an improvement upon it; if that superiority resulted from some addition to the latter it will have no tendency to avoid infringement, and it matters not that the addition or improvement is patentable or patented". See the many cases cited.

superiority and also to verify his theory that the hand-made tire must be inferior. On the latter point he testifies as to the first set of tests (Vol. I, p. 541):

> "Q. 64. Will you state under what circumstances and for what purpose?
>
> A. In connection with the various studies which I had made regarding the strength of tires, it seemed plain to me that the hand-made tire would not be as strong as the machine-made tire, and in order to determine whether or not my theory in this regard was correct, I had constructed a number of hand-made tires and a number of machine-made tires, and I burst these tires in an exactly similar manner to that already described, and found that my theory was verified."

The tests were *ex parte* and an objection has been made, although for the first time in defendant's brief, on the ground that defendant was not invited to be present. Such objection would go to the weight and not to the admissibility of the evidence. Walker, Sec. 498, page 563, states the general rule, and it will be observed in the several authorities that the question was frequently complicated by other considerations of credibility, importance, or the like. Here the evidence is merely explanatory of a principal fact already proved. Moreover, no proper objection was made. Defendant's counsel said (Vol. I, p. 528):

> "I object to any testimony as to the tests mentioned, on the ground that the same is immaterial, irrelevant and incompetent."

There is specific authority to the effect that this form of general objection is not adequate to embrace one as to the *ex parte* character of a test. See *Hoskins Mfg. Co.* vs. *General Electric Co.* (Ill.), 212 Fed. 422, 432; affirmed by 7th C. C. A. in 224 Fed. 464.

The testimony is well within the rule given in *Wigmore on Evidence,* Vol. II, p. 1725, § 1385:

> "Of late years, the fallacious suggestion has sometimes been made by unreflecting counsel that the rule requiring an opportunity of cross-examination applies to forbid the use of a diagram or model or map, or of a chemical analysis or other expert investigation, prepared or made out of court without notice to the other party. The suggestion is erroneous, for the reason that there *is* afforded in such cases the required opportunity of cross-examination, namely, when the witness who has made the model or the analysis takes the stand at the trial to testify to the results of his work. No more can be demanded. The map or model or analysis is not in itself testimony (*ante,* § 793); it is nothing until adopted by a competent witness as a part of his testimony and a mode of communication."

Defendant's counsel *did avail himself of the opportunity to cross-examine* the witnesses as to the tests at great length, as for instance, Ray in x-Qs. 140 to 236, Vol. I, pp. 569 *et seq.* Not only did he fail to object to the direct, but he conducted his extensive cross without reservation. He did not ask for a repetition of the tests. He did not ask for the privilege of making similar tests himself. He did not ask for surrebuttal, which is almost invariably granted in patent cases.

If defendant ever had the right to object, it was clearly forfeited. And in any event, the evidence is more a matter of interest than one of importance. The controlling feature is the independently proved existence of superiority.

Preparing the tires. Ray details at length (Vol. I, pp. 528 *et seq.*) just what he did. Mackey made the hand spun tires, and Shaw the tires on the Goodyear commercial machine. These carcasses were otherwise the

same in every respect. He used the same number of plies, the same materials, the same beads, the same chafing strips, the same rubber covering, etc. However, proof of their similarity does not depend upon testimony, as the tires themselves were introduced in evidence, Plaintiff's Exhibit No. 18, Hand Spun Tires, and Plaintiff's Exhibit No. 19, Machine Made Tires. Any point of difference would be readily apparent. He saw both Mackey and Shaw make the tires and saw them finished. Both sets were subjected to the same vulcanizing treatment. At the Goodyear plant a double-cure system is employed, the first step being to cure the carcass by itself, and the second step to cure it again after the tread has been applied. In this instance, as the tread was omitted, he directed a single cure of longer duration (Q. 19). He says (Qs. 20 and 21) that the reason the tread was omitted was because the only thing of interest was the strength of the carcass and the tread had no bearing on this.

In order to approximate closely to the conditions set up by defendant, who relies largely on the hand practice in the Diamond plant, an employé from that plant, Mackey, was selected to spin the tires. Mackey was produced as a witness and his deposition begins at page 414, Vol. I. He tells of his Goodrich and Diamond experience; of the official and authorized method there, viz., the sawtooth method; and of his own unauthorized practice of the hand spinning method. He tells (Q. 20) about making the tires, Exhibit No. 18; of his introduction to the Goodyear plant and his being requested to make tires by the hand spinning method as he did (Q. 24) at the Diamond plant; and (Q. 25) that counsel instructed him to make them of as good quality as possible. He started in and made a few experimental tires first to be sure that his hand had not lost its cunning; and then he made a set of ten tires from inappropriate

material, these affording him further practice. Then (Q. 29) he started in with the proper material and made another set of ten tires, Plaintiff's Exhibit No. 18, which he says (Q. 30) were made by the hand spinning method in the way he formerly made them in the Diamond plant, and with as much skill and ability as he was able to exert. Ray testifies (Vol. I, p. 532, Qs. 29, 30) that he observed Mackey closely and that he "was a very skillful tire-maker, and the work which he did on these tires was very carefully and perfectly done". In other words, all the conditions were favorable to the hand-made tires, as no such skill and care could have been regularly exercised in the earlier practice.

Ray produces (Vol. I, p. 530, Qs. 22 *et seq.*) the records or charts relating to the curing of these tires, Plaintiff's Exhibit No. 17 (Vol. 2, pp. 149, 151), and marks thereon the lines respectively referring to the two sets of tires, using "M" (Mackey's initial) on the hand-made tires.

The machine-made tires (Vol. I, p. 533, Qs. 32 *et seq.*) were made on one of the old State machines in the customary manner, and there was nothing unusual or extraordinary in their manufacture. The tires in this exhibit were marked with an S (Shaw's initial). Ray repeats (Q. 35) that the two sets of tires were exactly alike except as to the different modes of laying the fabric on the sides of the core, and were finished in the same way.

Bedell (Vol. I, p. 597 *et seq.*) testifies that he produced and delivered the same kind of material to both Mackey and Shaw, and that after the carcasses had been formed and finished, they were delivered to the curing room. He affirms the distinguishing letters, M on the Mackey tires, and S on the Shaw tires. Rowles, head inspector on curing (p. 606), speaks of receiving these two sets of tires marked "M" and "S" respectively, and of their being subjected to a single cure. He also identi-

fies the charts. However, his principal experience was in the double and not the single-cure process.

Therefore, Price (Vol. I, p. 614), of the technical service division, was called and testified that according to his tests the hand-made tires marked "M" (Plff.'s Ex. No. 18) were properly cured. And he states further that the tires marked "S" (Plff.'s Ex. 19) were properly cured. Referring to the curing charts, he says (Q. 10) that the two sets of tires M and S were subjected to a single cure and that "these charts indicate that the heat treatment thereby recorded was the proper curing or vulcanizing treatment for a single cure in connection with 34-4 tires". He was questioned as to a slight jog or depression in one of the lines on the chart, but says it "would not affect to any extent the efficiency of the particular cure". He had already stated that the exhibit tires were properly cured.

The actual test. Ray next describes (Vol. I, p. 534, Qs. 40 *et seq.*) the comparative test to determine the respective strength of the two sets of tires, which was the application of hydraulic pressure internally, the pressure required to burst each tire being observed and recorded. He selected this hydraulic test because it was searching and seemed the only one which would give a fair comparison of relative strength, and because it subjected the tires to stresses of a nature similar to those they have to withstand in service. He (Q. 42) regarded it as superior to the customary road test, because the latter had too many different and uncontrollable conditions, and moreover it would take too long. Further, he states that a tire usually fails finally by bursting. The apparatus he employed, and his methods of observation are described at length in Qs. 47 to 53, and need not be specially discussed herein.

Ray gives (Q. 54) a table of the respective pressures at which the hand-spun tires burst, it being noted that the

average of these pressures is 388.1 pounds. Similarly (Q. 55) he gives a table of the pressures at which the machine-made ties burst, the average being 435.75. Notwithstanding the very favorable conditions surrounding the production of the hand-made tires, it required (Q. 58) 12.3% more pressure to burst those made by machine. But this is not all, since (Qs. 59 to 61) in service the pressure to which such tires are subjected is 75 pounds, and this should be subtracted from each average to obtain the safety margin, which raises the percentage to 15.2%. Again (Q. 62), even the higher safety margin is not to be taken as a strict criterion in calculating the greater longevity of machine-made tires. Ray points out that the life of the machine-made tires would be much greater than that indicated by the mathematical figures, and gives his reasons at length.

Ray made still another test with substantially parallel results (Qs. 63 to 67) at the very outset, when to verify his theories, he procured a number of hand-made tires and a number of machine-made tires and burst them in a similar manner. This he did to determine whether or not it would be worth while to obtain a Diamond operator and make a more complete test. In this preliminary essay Shaw made both sets of tires, the machine-made tires bursting at 429.5 and the handspun tires at 383.6, the difference of margin of safety being again in the neighborhood of 15%. In other words, he obtained substantially the same results in both instances, although conducted at different times and under different conditions. The result of these comparisons is striking and positively confirms the theoretical differences.

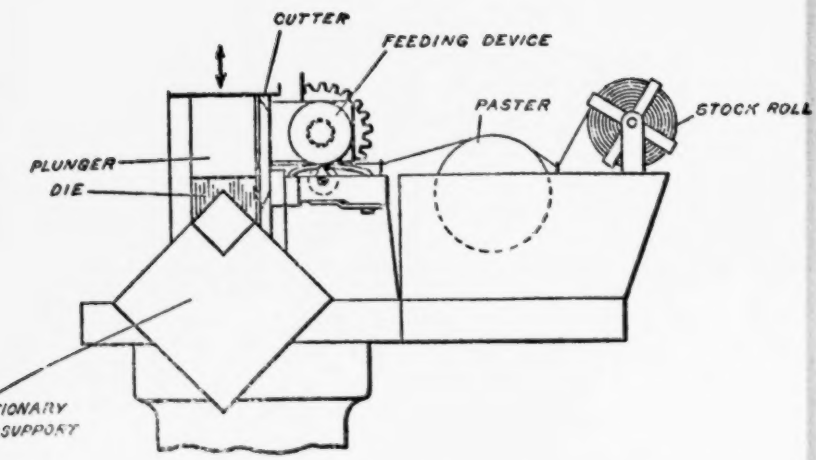
Hand Spun Tires do not Embody Double Stretch. Defendant, at several places in its brief, refers to the Mackey hand-spun tires as embodying the

feature of double stretch. The tires themselves, however, do not support the contention, but on the contrary, show that they are essentially in the single-stretch class. If there are any radial diamonds present at all, they will be found only in that portion of the fabric wrapped around the beads in the regular Goodyear finishing operation which was not performed by Mackey (Vol. I, p. 424, x-Q. 86).

Converting Hand Method into Machine.

It is believed that the Court has now arrived at the crux of this case. Defendant claims in effect that hand spinning anticipates, or at any rate negatives, the invention of State's patent. Plaintiff views it as a part of the proofs indicating the obstacles which State's research and experiments finally overcame. *What he did was to convert an ineffective, uncertain, imperfect hand operation into an effective, certain, perfected machine. He transformed a low-grade and irregular tire with unbalanced tension into a high-grade and uniform tire with balanced tension. And there was something more than this, since he substituted the double stretch system for the single stretch system.* In hand spinning, radial stretch was practically impossible, or else, if present at all, in such slight degree as to be negligible. The Courts, including this Court, have often found invention in parallel circumstances.

The leading case is *Hobbs* vs. *Beach*, 180 U. S. 383, involving a machine invented by Beach, which was the first to paste paper strips on the edges of boxes to stay or strengthen them, this operation having previously been performed by hand. It was the first to make a stayed box of this type by machinery. To make the simplicity of the mechanism clearer we append herewith a view taken from the Beach patent. The Beach machine



BEACH REISSUED PATENT NO. 11,167.

HOBBS VS BEACH 180 U. S. PAGE 38

embodied a stock roller carrying a roll of paper or fabric to be used for the stay strips, a paste-applying roller, over which the strip passes to have one of its faces supplied with adhesive material, a feeding mechanism for drawing the strip off the stock roller and over the paste-applying roller and for placing it in proper position over the box corner, a cutter for severing the continuous strip into stay-strips of suitable width, as well as a pair of opposing clamping dies on one of which the box is supported and the other of which acts, when it comes down, to shape and clamp and press the stay tightly in position upon the corner and thus to paste it permanently thereto.

Compare this comparatively simple subject matter with that embodied in the State machine, wherein, in addition to the provision of means for securing uniformity and precision of action, he embodied also his discovery of high speed, centrifugal force, and radial stretch. Nor

must it be forgotten that the Beach machine was not completely automatic, but pasted only one corner at a time, no instrumentality being provided to turn the box to its new position on the lower clamping die after each shaping, compressing and pasting operation. In the State machine, the mechanism for advancing the rolls is similarly controlled by hand. The Court said (p. 386):

> "Prior to the Beach invention, the work of thus strengthening the corners of paper boxes by these adhesive strips had always been performed *in a tedious and irregular way by hand.*"

And again (p. 393):

> "In passing upon the question of novelty we feel at liberty to consider the fact that the Beach machine and its congeners *have completely supplanted the former method of applying strips by hand;* that no manufacturer can successfully compete for the trade without adopting such machine; that it *not only applies these strips with much greater rapidity than is possible by hand, but the work done is stronger, cheaper, cleaner, and more uniform;* that the machine attaches the strip more rigidly about the corner, and that, by reason of its greater compression, forces out the moisture and dries the box for immediate use; that there is also a saving of material by cutting the strips of the proper length instead of tearing them, and that, by reason of the greater compression, heavier and stronger material may be employed than was possible when the work was done by hand. *We find no difficulty in holding that the first three claims of this patent were not anticipated by any prior devices.*"

This authority has been frequently followed by other Courts.

And there are other cases in which this Court has affirmed patentability over earlier hand methods. A very

recent one is *Hildreth* vs. *Mastoras,* 257 U. S. 27, wherein Chief Justice Taft says as follows:

> "The history of the art shows that Dickinson took an important but long delayed and therefore not obvious step from the pulling of candy by two hands guided by a human mind and will to the performance of the same function by machine. The ultimate effect of this step with the mechanical or patentable improvements of his device was to make candy pulling more sanitary, to reduce its cost to one-tenth of what it had been before him, and to enlarge the field of the art. He was therefore a pioneer."

There are other cases to the same effect, although in none of them is the parallelism closer than in *Hobbs* vs. *Beach.*

This doctrine is so well established that defendant is forced to acknowledge it. On page 13 of its brief, it says:

> "In order to avoid any misunderstanding, it should be stated at the outset that Defendant does not contend that a patent cannot be granted for a machine which carries out a method or process previously followed by hand. Indeed, some of the most valuable patents are in this class (*Hildreth* vs. *Mastoras,* 257 U. S. 27)."

The Court of Appeals below, in referring to this subject, stated as follows:

> "In this state of the art, in 1907 State undertook to adapt the other or hand roll method of making a double stretched tire to machinery. Certain elements entering into that problem were of course well known. That fact of the desirability of the initial circumferential stretch of the tread portion into circumferential diamonds, was in use; the lessening of stretch resulting in squares on the side of the shoe was a well known practice, as was also the radial stretch for the inner portion of the shoe,

> which turned the square of the fabric into a diamond shape at right angles with the diamonds of the initial or tread stretch. So also the use of a hand or spinning roll was well known, and the problem involved, as in most machine improvements, was to take these well understood and recognized processes which were done by hand and directed by skill, and do the same work by machinery. This problem State met, and for the first time successfully solved in a machine-made tire of the double stretch character indicated. The machine he produced was at once recognized. It went into instant use. On such machines millions of tires have been built, and large numbers of companies have taken out licenses under the patent."

As before pointed out, this matter was not touched upon in the *Firestone* case, and hence there is nothing in the opinion of the Court of Appeals for the Sixth Circuit bearing upon it.

***Penn* vs. *Conroy* Distinguished.** In connecnection with his apparent holding that State's invention was anticipated by hand spinning, Judge Bodine of the trial Court said:

> "If further authority is necessary see *Conroy* vs. *Penn*, 115 Fed. 421, affirmed 159 Fed. 943."

This involves an obvious confusion, no doubt arising from defendant's fallacious argument that State's claims as modified by the disclaimer in effect cover a method rather than a machine, with the result that a holding intended to apply to the first statutory class of invention (*i. e.*, "art") was construed by the Court to attach to the second statutory class (*i. e.*, "machine"). State's patent is unquestionably in the latter category. True, his claims set forth *a mode of operation* of the combined elements, but this is entirely proper, as will be seen from the authorities cited later on under the heading "*New mode*

of operation", page 172 *et seq.* Holdings and doctrine relating to method patents do not touch the present situation.

In *Penn* vs. *Conroy*, two patents were involved, one for a method or "art", and the other for a "machine". The invention related to the ornamentation of glass by chipping or scalloping. In the earlier practice this was effected by a hand operated tool. In the machine, the chipping pins were mounted on a drum or carrier and means were provided for holding the glass to be acted on. The method claim was as follows:

> "As an improvement in the art of shaping the edges of glass articles, the method herein described which consists in removing by blows at successive points closely adjacent to the edge, the edge and a portion of the opposite side of the article in pieces approximately uniform in quantity, substantially as set forth."

This was invalidated on the prior hand practice. The *machine* claim was as follows:

> "In a machine for shaping the edges of glass articles, the combination of a carrier having a series of two or more pins secured to the carrier and spaced in the direction and transversely of the path of movement of the carrier so as to operate successively and at different points on the article, means for moving the carrier and a rest or bearing arranged to support the article adjacent to the edges to be operated on, substantially as set forth."

This claim was held valid and infringed. The Court said:

> "*The machine because of the rapid and uniform character of its work has supplanted the old hand method.* We deem it unnecessary to discuss in detail the prior art, since it does not disclose anything which can properly be considered as an anticipation of the complainant's *machine* patent. *He was the first to devise a practical machine* for decorating glass."

It is submitted that the general finding makes a clear distinction between machine patents and method patents when considered in connection with earlier hand practice, and one entirely in favor of plaintiff here. State's patent is for a machine. In relying on this authority, the trial Court erroneously assumed it to be for a method.

The State Patent.

The patent in suit presents clearly the State mechanism previously described. Plaintiff's expert (Vol. I, Q. 8, pp. 27 to 31) first describes the necessary changes in the reticulations of the fabric, so that when laid on the core, there will be diamonds in the tread portion with their long dimensions circumferential, which diamonds merge into squares at the median line, which squares in turn merge into diamonds with their long axes radial in the bead zone, all as illustrated in the previous diagrams. These changes are effected by the double stretch system, wherein by suitable tension devices the fabric is first applied to the core with *circumferential* stretch, and then the unattached skirts are applied to the sides of the core by forming rolls with *radial* stretch. While most of the claims in suit refer more particularly to the side-forming action of the rolls on the skirt, it is thought desirable to describe briefly the devices whereby the fabric is first applied to the core. For that purpose, Figs. 2 and 7 of the drawings are here reproduced.

The fabric from the supply or stock roll passes around rollers, one of which is a tension roller to which tension is applied by the mechanism illustrated in Fig. 7, and the leading end of the fabric is cemented to the core, as shown in Fig. 2. This reference to the tension devices is adequate for the present and later they will be taken up more at length.

W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962. Patented Nov. 30, 1909

6 SHEETS—SHEET 1

Fig. 7.

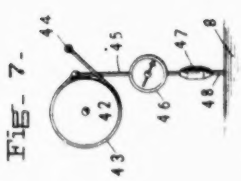
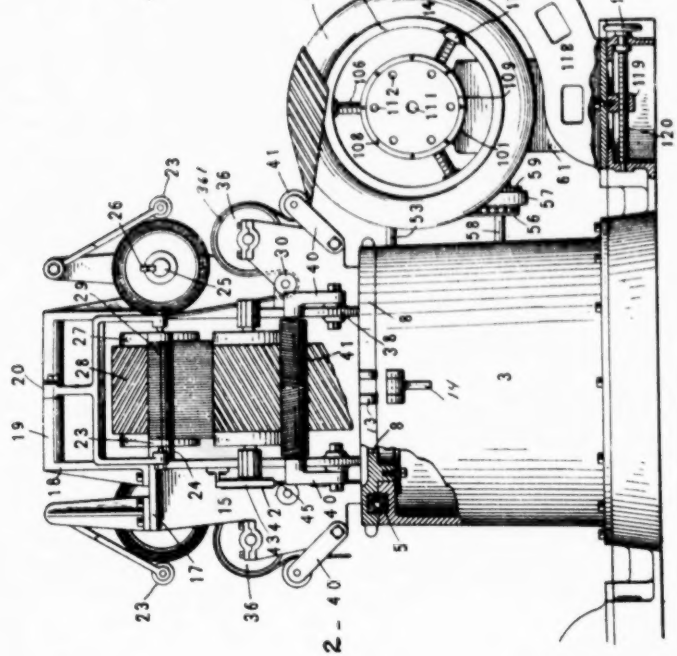


Fig. 2.



WITNESSES

INVENTOR

Walter C. State

BY

ATTORNEYS

The core is then slowly rotated, thereby drawing off the fabric under tension from the supply roll and giving the desired uniform stretch to its middle portion. The beginning of this operation is shown in the drawing. The specification says:

> "I apply the canvas to the power-driven ring-core while this is moving quite slowly, say at six revolutions a minute" (p. 2, lines 1 to 4).

The rotation of the core is continued until a layer of fabric has passed completely about it. It is then stopped and the fabric is severed by the workman, who fastens its last end so as to overlap slightly the leading edge, the rubber compound with which it is impregnated ensuring its adhesion. At this stage the fabric has been circumferentially stretched so as to conform it to the tread zone of the core, but its margins or skirt portions are unattached and in a loose and baggy condition.

The machine is provided with speed changing mechanism, which will be examined later on. This mechanism is brought into play and the ring-core is rotated at high speed during the subsequent action. In this connection the specification says:

> "* * * I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at two hundred and seven turns a minute. By this means the machine not only does more work in a given time but it does better work" (p. 2, lines 4 to 11).

As before discussed, this speed of 207 R. P. M. is given merely by way of illustration. The speed of the original machine, Plaintiff's Exhibit No. 2, was 230 R. P. M., which was cut ten per cent. before the application was filed, and later on was diminished still further. The

speed indicated in the specification was quite sufficient for the purpose. Under the law, all that is required is something practicable, and it is not a defect, if subsequent experience shows that something else is better. The preferred commercial speed at the present day is between 120 R. P. M. and 150 R. P. M.

Tread Roll. Before discussing the spinning rolls, reference is made to the tread roll 141, which is shown as pressing the already stretched portion of the fabric on the tread zone of the core. The purpose of the tread roll was to bear on the fabric "which actually forms the tire tread to thoroughly smooth it and shape it to the core" (p. 5, lines 58 to 60). It will be seen from this description that the tread roll is merely auxiliary to the original circumferential stretching. The testimony shows it is often omitted. The present case is not concerned with it. It was a part of the earlier litigation. But the claims embodying it have been since eliminated by disclaimer.

Forming Rolls. The next topic is that involved in the claims here in suit, namely, the forming- or spinning-rolls which apply and shape the unattached skirts of the fabric to the sides of the core, while the latter is rotating at its fast speed. It may be here noted that this description applies equally well to defendant's machine, wherein the action of the forming-rolls is the same as that of the rolls of the State patent. Such differences as may exist do not affect the present subject matter, as will be later pointed out.

These rolls are best shown in Figs. 9, 12*b* and 12*c*, the latter two figures being here reproduced. There is a pair of these rolls which simultaneously act upon opposite sides of the core and upon the respective skirts of the fabric. They are supported by a sliding carriage which is movable radially with respect to the rotating core. This carriage is accurately guided and is moved inwardly by a

State Patent

Fig. 12b

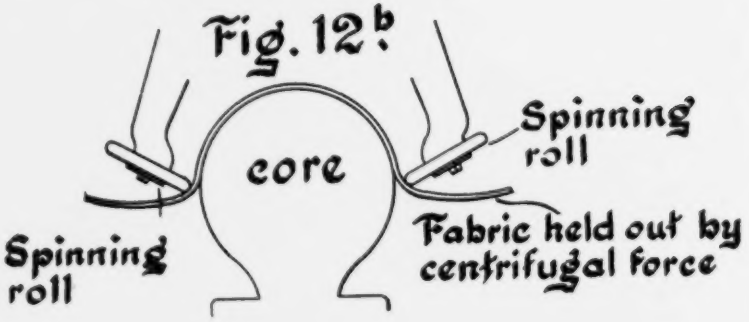
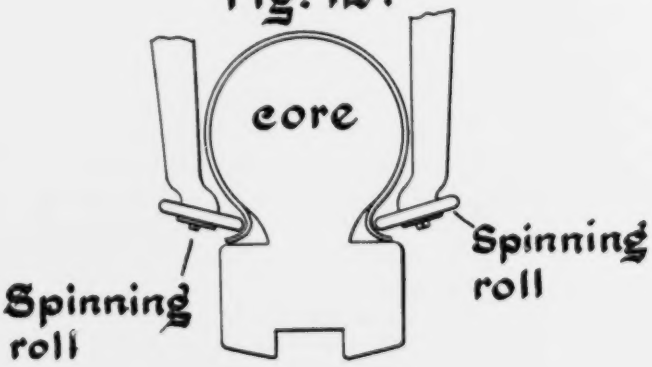


Fig. 12c



screw feed so that the forming- or spinning-rolls are also gradually fed inwardly as the core rotates. Also, each forming- or spinning-roll is pressed toward the core so as to press forcibly upon the portion of the fabric which it bears against. This arrangement has been already described in connection with State's experiments. The carriage is shown at 123 in Fig. 6, and is guided mechanically to slide radially with respect to the core. It is gradually advanced by a feed screw controlled by the hand wheel 124. Mounted upon this slide, is the rotatable head or turret (Fig. 9), which not only carries the forming- or spinning-rolls, but also the tread roll, the bead-applying rolls, and the trimming cutters. By turning the turret, any one of this set of tools may be brought into co-action with the core. However, the turret and these other tools need not be considered. The only tools here involved are the two forming- or spinning-rolls, and only when they have been located in proper relation to the rotating core so that they may be advanced along its sides.

Each of the rolls 147 is rotatably mounted on the end of a pivoted lever, and each of these levers is acted upon by a spring 145 which presses the roll against the fabric on the core, in the manner already described in the review of State's experiments. As the function of these springs seems to loom large in defendant's mind, it is believed proper to quote at length from the specification concerning them:

> "* * * The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, strong spiral springs will be used" (p. 5, lines 108 to 113).

The specification further states that weights can be substituted for the springs:

> "* * * And it is of course understood that there may be substituted for the springs and as an

equivalent therefor the more cumbersome device of a weight constantly tending to force the spinning-rolls, with considerable pressure, toward the ring-core" (p. 5, lines 121 to 127).

Also, the spinning-rolls may be pressed toward the core in other ways:

> "* * * In a broader aspect of my invention, however, I may employ mechanical instrumentalities, not the hands of the operator, other than springs or weights for pressing the spinning-rolls laterally against the ring-core. I shall, then, use the term 'power-pressed' to cover generally not only springs and weights but other mechanical instrumentalities for pressing the spinning-rolls against the ring-core" (p. 6, line 2).

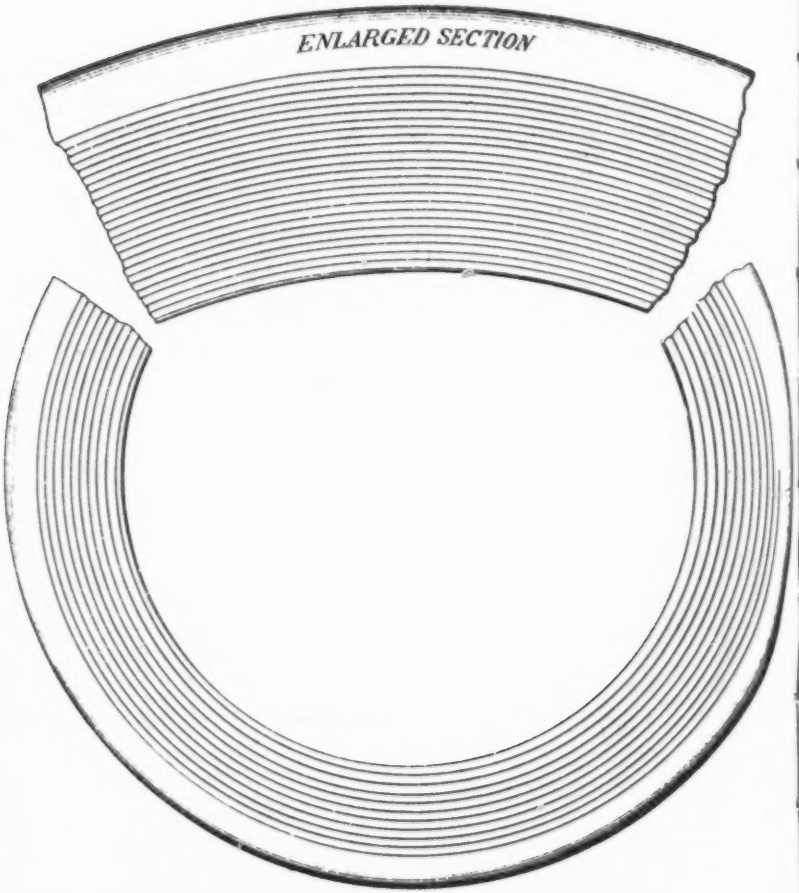
In addition, as shown in the drawings, the plane of rotation of each roll is not perpendicular to the plane of rotation of the ring-core, but is at a receding angle thereto:

> "* * * It will be noted finally that I mount the spinning-rolls with their plane not at a right angle to but to recede at an acute angle from the plane of the ring-core. The fact is when the ring-core is rotating at high-speed, the centrifugal force tends to throw the fabric out at a right angle from the core-plane and unless the roller recedes in the manner shown, the fabric will become entangled with it" (p. 6, lines 33 to 42).

As shown in the drawings, each roll has a rounded working edge:

> "* * * While I have shown these spinning-rolls as disk-shaped throughout, it will naturally be understood that the disk-like or narrow character of the rolls is only essential at the periphery, which is rounded and not sharp so as not to cut the fabric" (p. 6, lines 17 to 23).

STATE'S SPIRAL PATH



Action of Rolls. The effect of the high speed of the core is to throw out the skirts of the fabric by centrifugal force, somewhat as indicated in Fig. 12*b*. The result is that the skirts are projected outwardly in a stiff and smooth condition, thus eliminating any tendency to fold or wrinkle. The rolls are then brought into action and each roll initially presses and acts upon the hinge of the corresponding skirt. That is to say, at each edge of the already attached tread portion, the skirt is thrown out by centrifugal force at the line where the adherence of the fabric to the core ceases, and this line constitutes a hinge on which the outstanding skirt turns. It is at this hinge line that the effective action of the roll takes place. Each roll presses against the fabric at this line, thus forcing that particular portion against the core and causing it to adhere thereto (Vol. I, p. 37).

As the core rapidly rotates, the rolls are fed gradually inward with the result that each of them traces a spiral path with respect to the core and the fabric thereon, as shown in Plaintiff's Exhibit No. 12, here reproduced. The successive convolutions of this spiral are brought closely together by the small progressive advance of the spinning-rolls, so that each roll can act successively only upon small or elemental areas. *The uniform and close arrangement of the successive convolutions was impossible in hand spinning, and is secured by State's mechanical devices which prevent slipping and jumping.* In practice, the distance is about one-eighth of an inch, and these small areas are folded down successively until the entire skirts are laid smoothly, uniformly and accurately against the sides of the core (Vol. I, p. 38).

During this folding action, the centrifugal force acting in opposition to the inward pressure of the spinning-rolls maintains the unattached portions of the skirts smooth and wrinkle-free, with the result that the formation of wrinkles in the applied fabric is prevented.

Plaintiff's expert also points out (Vol. I, p. 65, x-Qs. 88, 89) that the roll does two things simultaneously, one portion of its rounded edge pressing the fabric against the core, and at another portion bearing upon that part off the skirt which is held outwardly by centrifugal force. It is the frictional engagement of the outflung skirt with and about the rounded edge of the roll that affords the necessary resistance to secure the radial stretch.

In view of the fact that the main movement of the roll is predominantly circumferential, the radial component being relatively small, it might seem that the effect would be to stretch the fabric circumferentially and not radially (just the opposite of what is desired); but the fact is that the fabric is stretched radially and not circumferentially, and this is due to the frictional resistance of the outflung skirt to the advancing roll. That is to say, the result secured is that indicated in the diagram "Fabric Shaped to Core", wherein at the head zone the reticulations are converted into radial diamonds or lozenges by the radial stretch.

As a matter of convenience, and particularly to emphasize the distinction over the single stretch system, is next given the following concise résumé of the characteristic features of the State mode of action (Browne, Vol. I, p. 38).

1. *Centrifugal force* due to the high speed which holds the skirt away from the core in stiff, smooth and wrinkle-free condition and under tension, the resistance being sufficient to produce radial stretch as the roll advances.

2. *The progressive advance* of the roll which establishes a base or hinging line along one portion of its spiral path, and then a new base or hinging line along the next portion of the spiral, and so on.

3. *The hinging or folding action* over small areas of the fabric so that it contracts circumferentially

and is laid down wrinkle-free along the zone of the narrow advance.

4. *The cementing or adhesive action* of the rubber which holds the fabric firmly after it is pressed against the core.

The ultimate effect is the re-arrangement of the threads or cords of the fabric so that all its portions are smoothly attached to the core (Browne, Vol. I, p. 39). The mode of operation and the elements producing it are the outstanding features of State's invention. Also, they are present in defendant's structure. And finally, they constitute the subject matter of the claims in suit.

What the Court of Appeals for the Third Circuit Found to be State's Invention.

In reading the opinion of the Court of Appeals for the Third Circuit, rendered in this case, it should be borne in mind that Judge Buffington, who wrote the opinion, had before him this very full record in which two distinct prior hand practices are discussed, namely, first, that which has been referred to as the double-stretch saw-tooth method, in which the fabric is first stretched around the circumference of the core and the core is then rotated, step by step, as the operator with one hand pulls out or stretches the fabric laterally and radially while, with the other hand, he applies a hand-held roll to the skirt of the fabric in a zig-zag or saw-tooth course, so as to lay the fabric against the core and produce a radial stretch or elongation of the meshes of the fabric, as more particularly hereinbefore described (*ante*, p. 8); and, secondly, the so-called hand-spinning method, pure and simple, in which the fabric is first stretched around the circumference of the core, the core then rotated or spun, by

one hand of the operator, while a spinning roll, held in the operator's other hand, is pressed against the fabric to lay it against the sides of the core; the product, in this instance, showing little, if any, radial elongation of the meshes of the fabric (*ante*, p. 17).

When Judge Buffington, therefore, said that

> "tires embodying these two features of *double stretch* and *roll-spinning fastening*, were, before the patent to State, here in question, hand made",

he was, of course, stating a fact, and had both prior hand practices in mind.

After quoting Judge Denison's exposition of the common or saw-tooth hand practice, Judge Buffington next refers to the Seiberling and Stevens machine as an attempt to make a machine-made product, which was a commercial failure, and then approaches the State invention, first reciting the results attained by State, and afterward referring to the combination of mechanism by which those results are accomplished.

He says:

> "In this state of the art, in 1907 State undertook to adapt the other or hand roll method of making a double stretched tire to machinery. Certain elements entering into that problem were of course well known. The fact of the desirability of the initial circumferential stretch of the tread portion into circumferential diamonds, was in use; the lessening of stretch resulting in squares on the side of the shoe was a well known practice, as was also the radial stretch for the inner portion of the shoe, which turned the square of the fabric into a diamond shape at right angles with the diamonds of the initial or tread stretch. So also the use of a hand or spinning roll was well known, and the problem involved, as in most machine improvements, was to take these well understood and recognized processes which were done by hand and directed by skill, and do the same work by machinery. This problem State met, and for the

first time successfully solved in a machine-made tire of the double stretch character indicated. The machine he produced was at once recognized. It went into instant use. On such machines millions of tires have been built, and large numbers of companies have taken out licenses under the patent."

Still continuing to characterize the State invention by its functions and results, he says:

"Analyzing such machine, we note that in the tread circumference there is a low speed, and we there start with a circumferential stretch and a circumferential diamond-shaped interstice. Its separate processes and their product do not end and are not completed at any given point, but as each distinct process and mode of operation begins and carries on it correspondingly modifies the product, and as the machine functions in its entirety, there is a gradual and progressive change in the continuous operation and in the progressing and changing product, which gradually, uniformly, evenly and continuously changes the product of the machine from the initial circumferential stretch and the circumferential headed diamond-shaped interstices into a gradual approach to the normal square with its substantially unstretched fabric into which the product gradually shapes itself up to the side or median line. But the process does not stop here, for there is still a continual shading, this time from the square of the median zone of the tire side into the radial circumferential stretch of the bead or inner portion of the tire, and a gradual departure from the unstretched square of the median line to the radially stretched and radially pointed diamond shaped interstices of the bead or inner portion. Far from being separated, isolated zone processes, there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the consequent exercise of centrifugal force on the covering material, by which it is automatically gradually stretched radially *and by the joint action of such centrifugal,*

radial stretch, and the spinning rolls, the square of the median zone progressively shades into the radial diamond shaped interstices of the bead or inner zone of the shoe.

In a way we have anticipated what State's *machine* really is, by thus describing its *results*. But such statement should be initially made, for the crux and dominating *functional feature* of State's machine is the use upon the fabric of a centrifugal force caused by rapid rotation, a process which is wholly different from the original hand process, and one which State in the experiments which he carried along in the development of his machine, first found he could utilize. Briefly stated, his machine may be thus described: He took the old core wheel of the hand process, and used impregnated strips of fabric and formed the outer or tread portion of the shoe and cemented is to the core, just as had been done in the old hand process. He continued that process just as it had been in the hand process, down to the point where he plastered or cemented the fabric on to the core down to the median line point. But here he changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric.

At this point we note that State made use of a shifting platform, on which he mounted on each side of the tire spinning wheels or rolls so pressed inwardly by springs that as the rolls revolved they engaged and pushed inward and against the sides of the core the stretched flying skirts of the fabric. Thereby he then, *and by the wheels*, pressed and cemented *the radially stretched and therefore puckerless fabric* against the lessening sides of the shoe clear down to the bead edge. It will therefore be seen that the *essence of his disclosure* was the *rapid, sustained, regular revolution of his core*, the use of a *shifting platform* on which he *located his spinning*

rolls, and the *constant, regular and uniform exertion of pressure* upon those spinning rolls, *causing them to automatically press the automatically stretched and loose fabric, or skirts, in an unwrinkled state, on the bead of the lower surface of the core.*

If this statement of the process be correct, and there can be no doubt in that regard, it follows that the process is a unitary one, is a continuous one, is an interrelated one, is an undivided one, and that there is a continuity of uniform, sustained, progressive, advance from the start to the finish of this machine-made tire, which is brought about *by the rapid revolution of the core wheel acted upon by the spin of spring-controlled engaging rolls co-operating with the centrifugal force generated by the rapid motion of the core.* In other words, *united, co-operating, conjoint functioning of the core speed and spinning rolls, effected by roll springs and the shift of roll platform*, all conjointly functioning to produce a unitary machine result which neither of them separately could effect. Such being the *mechanical fact*, who shall combat the patent deduction that these elements brought together and assembled for the first time by State, *stamp the combination as an inventive combination* and not as a mere mechanical aggregation of disjointed steps.

At no single stage of this machine's processes do we find a complete, separate, finished entity. Standing alone, the tread with its circumferential diamond shaped interstices is nothing; the median or square portion with its normal square is nothing; the bead with its radial stretch and diamond pointed interstices is nothing. *It is when each co-operating element in combination with its fellows has done its individual but still co-operating work*, we produce the unitary and finished product which State for the first time made by machinery and which made such a great change in the tire art. *Each element acts and has to co-act with its fellows to produce the unitary result* and make the unitary product which alone the machine was fashioned and devised to produce."

The picture presented to Judge Buffington's mind was the contrast of the construction and operation of the instrumentalities employed in the execution of the ordinary hand-spinning process, on the one hand, with the construction and operation of the new combination of instrumentalities of State, on the other hand. He saw that, in the hand-spinning practice, there was a core which was rotated by hand at a low, irregular and diminishing speed, quite incompetent to stretch and efficiently throw out the skirt of the circumferentially attached fabric; while, in the State machine, there was a core, driven by power at a uniform speed sufficiently high to throw out the skirt of the fabric by centrifugal force. He saw, in the hand practice, a hand-held spinning roll which an operator was endeavoring to apply by the strength of his hand and arm to the skirt of the fabric with a necessarily variable pressure, on a line more or less radial and with an unregulated degree of advance; while in the State machine, he saw a spinning roll carried by a hinged support which, in turn, was mounted upon a carriage that worked in fixed guides that *compelled* a movement of the spinning roll in a fixed radial line, and which spinning roll was also automatically pressed to its work by a spring that exerted a pre-regulated uniform pressure upon the outflung skirt of the fabric and that was no more tired at the end of the day than it was at the beginning.

He saw that, whereas the radial advance of the spinning roll, in the hand practice, was not only in a more or less irregular path under the varying pressure of the hand and arm of the individual operator, but also at an irregular rate dependent entirely upon the skill and strength of the operator; whereas, in the State machine, he saw that the spinning roll was not only advanced in a fixed, definite path under pre-regulated pressure, but at a rate governed by an accurate screw feed

which could be regulated and controlled to a nicety. And he finally saw that, whereas, in the hand practice, due to the low speed of the core and the necessarily irregular mode of application of the spinning roll to the skirt of the fabric, the latter, if stretched at all, would be stretched so little as not to elongate the meshes of the fabric, radially, as the bead was approached; while, in the State machine, due to the high, uniform rotation of the core by power, and the consequent violent outflinging of the skirt by centrifugal force, and the application of the spinning roll to such outflung skirt, there is brought about the requisite radial stretch of the fabric and the radial elongation of the meshes thereof through the bead zone.

In other words, the learned Judge visualized, in the State machine, the combination of

(*a*) a rapidly rotating core upon the periphery of which the strip of fabric was applied and circumferentially stretched and by the rotation of which the skirts of the fabric were violently thrown out by centrifugal force to render them puckerless, wrinkleless and taut;

(*b*) spinning rolls for acting upon the outflung skirts of the fabric at their attached or hinged portions;

(*c*) hinged supports for the spinning rolls;

(*d*) power pressure means applied to the spinning roll supports for keeping the spinning rolls to their work under pre-regulated pressure;

(*e*) a radially sliding carriage running on fixed guides, upon which carriage the spinning roll supports were mounted, for compelling the traverse of the spinning rolls invariably in right lines;

(*f*) and means (the screw feed) for positively and regularly advancing the spinning roll carriage in its fixed path of movement,

whereby the power-pressed spinning rolls were applied to the centrifugally outflung taut skirts of the fabric from the hinge portions toward the edges thereof in always advancing definite spiral lines of contact, resulting in the uniform radial stretching of the meshes of the skirts of the fabric and the close application of said skirts through the bead zone of the tire, without the puckering or wrinkling of the fabric at any point.

Defendant would have this Court believe that Judge Buffington pitched the whole novelty of State's achievement on what he conceived to be the action of centrifugal force upon the skirts of the fabric to elongate the meshes thereof radially under the high rotation of the forming core; but nothing could be further from the fact, as shown by the italicized passages of his opinion, above quoted.

It was the new combination of the high speed core with the spinning rolls mounted to travel at regulated degrees in fixed radial guides and under pre-regulated pressure that he characterizes as State's invention.

Whether the centrifugal force applied to the outflung skirts of the fabric is sufficient, in and of itself, to effect, or to initiate, the radial elongation of the meshes of the fabric through the bead zone, is quite immaterial. Judge Buffington may or may not have ascribed too much power to that force; but the outstanding *material fact* is, that he finds that it is the combination of (1) the high speed power-driven core that functions to violently fling out and outstretch by centrifugal force the skirts of the fabric so that they shall be puckerless, unwrinkled and taut, with (2) the mechanically guided, power-

pressed, mechanically advanced spinning rolls, that does effect the radial stretching of the meshes of the fabric through the bead zone of the tire. It is neither of these instrumentalities *alone*, but the *combination* of all of them that constitutes the novel, patentable entity. That the ultimate result of the action of the co-operating elements of the recited combination upon the skirts of the fabric is as stated, admits of no dispute, upon the proofs in the case (Waterman, Vol. I, p. 283, Q. 73). The share that each of the elements contributes to the result can be of no particular moment, so long as the result itself is reached by their co-operative combined action.

In view of defendant's present contentions, it is interesting to note the following admissions made on page 133 of its brief below:

> "It does seem to be a fact that, if a machine generally similar to that of the patent in suit is arranged to be operated with the core having a high speed rotation in the neighborhood of that specified in the patent (207), the spinning rollers can act upon the skirts of the outlying fabric so as to stretch them and change the recticulations of the fabric near the bead portion from a square shape to a diamond shape with the long axis radial."

Claims in Suit.

The meaning of the selected claims is clarified and qualified by the disclaimer, which will be subsequently discussed. For purposes of convenience, pertinent portions are respectively quoted in connection with the several groups of claims.

First Group.

> "4. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support for passing radially along

the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

5. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

6. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disk-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

7. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disk-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described."

This first group of claims is to be construed in the light of the following language extracted from the disclaimer:

"In respect to each of claims 4, 5, 6 and 7, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the ring-core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force, and the recited spinning-roll support

is mechanically mounted to ensure its radial movement with a gradual advance in proper relation to the fast rotating ring-core, whereby the spinning-roll, by such gradual advance over the ring-core and while pressed toward it, acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith."

SECOND GROUP.

"12. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving spinning-roll for passing radially over the side of the tire-shoe to shape the fabric on the core, fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

13. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving support laterally power-pressed against the ring-core, a spinning-roll mounted on the support at a receding angle to the ring-core to pass over the side of the tire-shoe to shape the fabric on the core, a fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described."

This second group of claims is to be construed in the light of the following language extracted from the disclaimer:

"In respect to each of claims 12 and 13 of said patent, I hereby disclaim any combination of the recited elements *except for* the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited

ring-core and thereafter shaping and applying to the ring-core the fabric beyond the tread portion, *and unless* the recited elements are so constructed and co-ordinated that before the change from slow speed to fast speed the fabric strip as drawn from the recited stock-roll onto the ring-core is stretched circumferentially under uniform tension while applying it to the tread portion, and, after the change to fast speed, the unapplied fabric beyond the tread portion is thrown out from the side of the ring-core by the consequent centrifugal force, while the recited spinning-roll, in its radial movement, acts gradually upon the centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core beyond the tread portion while bringing it into adhesive contact therewith."

THIRD GROUP.

"22. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

23. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

24. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll having a rounded, disk-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

25. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll having a rounded, disk-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

26. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core for drawing the sheet-fabric from the source of supply in a flat condition, a radially sliding support, and a laterally yielding spinning-roll on the support for passing radially along the sides of the ring-core to curve and shape the sheeted fabric thereon, substantially as described."

This group of claims is to be construed in the light of the following language extracted from the disclaimer:

"In respect to each of claims 22, 23, 24, 25 and 26, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll, in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith."

Defendant's Expert Criticisms.

Defendant's expert has elaborated various fantastic theories in connection with the State disclosure. In most instances their absurdity is patent, and they come to an

untimely and tragic end, which is the fate of theory when it encounters destructive fact.

For the most part he bases his arguments on trivial draftsmen's errors, notably in Figs. 12 to 12c. It is thoroughly established law that patent drawings are not working drawings and are not made to scale. These selected figures are merely rough diagrammatic sketches intended to illustrate to the eye certain special features. To base a theory on such purely conventional illustration is totally improper, and particularly when the alleged mode of action is directly contradicted by clear description in the specification.

Initial Circumferential Stretching. For instance, he says in effect that Fig. 12 does not properly illustrate a circumferential stretching operation, and that the tension employed is not sufficient to shape the fabric over the tread portion. This is without foundation as the specification does not say that Fig. 12 shows any such thing. Plaintiff's expert points out (Vol. I, p. 442, Q. 12) that this figure indicates "the condition when the workman first brings the leading edge of the fabric into contact with the periphery of the core". If defendant's expert had really sought information on the stretching operation, he would have turned to Fig. 2, the only figure in the case which shows it, and wherein the ply is shown as attached to the core and being stretched over the tread portion by the tension devices. In addition, this allegation by defendant's expert of little or no initial stretch is largely contradicted by his own previous and apparently forgotten statement in discussing the State patent (Vol. I, Q. 5, p. 213):

> "In the condition shown in Fig. 2, the workmen would engage the low speed drive to revolve the core 115 slowly, thereby drawing the fabric from the supply *and stretching it at the same time.* A tension mechanism is provided for the tension roll 36, which

> is seen at the left of Fig. 2 at 42, 43 and more in detail in Fig. 7 on the same sheet. The purpose of revolving the core by power is to *relieve the workmen of the physical strain of stretching the fabric, thereby getting a more uniform stretch.*"

Moreover, the State patent fully describes a tension mechanism to resist the rotation of the fabric-supply rolls. It is illustrated in Fig. 7 and tension is repeatedly referred to in the specification,—at page 1, lines 97 to 102; page 2, beginning at line 101 and extending through to line 33 of page 3; at page 3, lines 69 to 72; and at page 6, lines 106 to 114. For instance:

> "The tension-roll constitutes a highly important element since it secures the application of the several layers of fabric to the ring-core with a uniform degree of tension" (p. 2, line 107).

And again:

> "If increased tension is desired on the tension-roller 36, the turn buckle 47 is manipulated so as to cause a contraction of the friction band 43 on the disk 42 to a determined degree, indicated by the gage 46 so that a predetermined amount of resistance will be offered to the turning or movement of the tension-roller 36."

Undoubtedly all this contemplates tension mechanism adequate to stretch the fabric to any desired extent as it is drawn on to the slowly rotating core. In addition, several witnesses testify that the stretch employed in the commercial State machines, including Plaintiff's Exhibit No. 2, is twelve per cent. See for instance State's answer to Q. 197, p. 328, Vol. I.

Tread Roll. With regard to Fig. 12', defendant's expert in effect alleges that after the fabric is thus lightly applied to the core, the tread roller 141 is relied on to

shape it to the tread zone. As already pointed out, the fabric is stretched circumferentially on the core, and the stated purpose of the tread roll is to smooth the "tread" and free it from air bubbles or wrinkles, if such be present. In other words, it is merely a precautionary device, and is in no way involved in the present litigation. These functions of the tread roll are fully described in the State specification, as at page 5, lines 54 to 60, and lines 83 to 89.

Spinning-roll action. These expert assumptions of mode of operation become more grotesque as they proceed. Referring next to Figs. 12*b* and 12*c*, and because in this diagrammatic illustration the rolls are not shown as actually pressing the fabric against the core, defendant's expert theorizes that this never happens and that the rolls lie and act in the loops of the skirts "instead of pressing the fabric strongly against the core". This amazing phenomenon he attributes to the high speed stated in the specification as "*say* at two hundred seven turns a minute", given by way of example. As before pointed out, this speed of 207 R. P. M. is ten per cent. less than that of the first commercial machine.

Just how State's rolls could operate in the loops of the fabric and without pressing it against the core is not explained by defendant's expert, nor is it capable of explanation. Defendant would have the Court believe that for some occult reason, like the suspension of Mahomet's coffin, the rolls would not press against the core notwithstanding the "strong springs" provided for that purpose. Such an effect would involve an operation of mechanical forces totally unknown to man. It is based entirely on the diagrammatic illustration, the purely conventional nature of which is further indicated by the fact that in Fig. 12*c* the rolls are carelessly shown as *not even in contact with the fabric.* This space is more

apparent in the lighter prints; in the blacker prints, like that in the record, the thicker lines merge and tend to obscure it.

State says (Vol. I, p. 328, Qs. 202, 203) that in his machine the rolls always press the fabric against the sides of the core; and that he never knew or heard of a mode of operation wherein the rolls were held outwardly away from the core by reason of the centrifugal effect of the outflung skirts. In the commercial machine, the fabric is always pressed against the core. This is so also in Plaintiff's Exhibit No. 2 (Vol. I, p. 447, Q. 18) wherein the speed is higher than that suggested in the patent.

Moreover, this theory that the rolls do not press the fabric against the core is killed by the very precise description in State's specification to the contrary effect. Note the language of the sentence on page 1, lines 57 to 61, which says that the rolls "gradually *press* the canvas *in contact* with the sides of the ring-core". Again, at page 5, lines 93 to 97, the rolls are said to "exert considerable *pressure on the fabric*". At page 5, lines 108 to 117, it is in part stated that "*strong* spiral springs will be used. These springs exert *pressure against* the fabric for forming it *against* the sides of the core." Again, page 5, lines 129 *et seq.*, State says that the rolls may be "either spring or weight *pressed* laterally *against* the ring-core". In the passage on page 6, lines 2 to 17, weights, springs or other power are described three times as "*pressing* the spinning-rolls" "*against* the ring-core". In the claims in suit the roll is described as pressed toward or against the core, for instance in claim 13, it is said to be "power-*pressed against* the ring-core".

Moreover, in stating this theory, defendant's expert relies entirely on the two or three diagrammatic views, and utterly ignores the mechanical view of Fig. 9, wherein the rolls are clearly shown as pressing the fabric against the core. He *does* refer to the roll 147 "shown

in Fig. 9" at an earlier point when he is outlining the disclosure of the patent (Vol. I, p. 214), and as in a previous instance, his testimony then directly contradicts his later theory. He said,

> "Thus by simultaneously operating the hand wheel 124 and the handle 142, the operator performs the smoothing down of the fabric *against the core, just as was usual in the hand building of tires.*"

This amusing inconsistency occurs, because in the quoted language he was endeavoring to emphasize anticipation by hand spinning. He forgot this position when later on he began to develop the theory that the rolls did not press the fabric against the core at all.

Even though an undue amount of space may have been allotted to these expert theories, it seemed advisable, not alone for the purpose of exploding them, but chiefly to indicate the strained and untenable character of the defenses.

Drawings generally. These expert criticisms and theories have been based largely on rough and diagrammatic illustration, which is perfectly permissible in patent drawings. And even assuming that the errors were more important ones, they are of no consequence if the description be clear. The authorities are numerous and as they are to the same effect, only a limited number need be referred to:

Western Co. v. *American Co.*, 131 Fed. 75:

> "The drawings are not required to be working plans. They must be read in connection with the description and claims and any inferences arising from omissions or inconsistencies in the drawings must yield to a legally sufficient specification."

Cutler-Hammer Mfg. Co. vs. *Union Electric Mfg. Co.*, 147 Fed. 266 (269):

> "To dispose of these two objections we must remember that the drawings of a patent are addressed to those who are skilled in the art. Furthermore, drawings must be considered in connection with the claims and specification, and each figure must be construed in the light of the other drawings."

Manhattan Co. v. *Fuller Co.*, 204 Fed. 287:

> "Undoubtedly a patented device is not to be held inoperable because slavish adherence to the drawings develops obstacles. Such drawings are often diagrammatic, and rarely, we fancy, drawn to a scale."

American Valve Co. v. *Fairbanks*, 249 Fed. 234:

> "It is also claimed that the patent drawings, if scaled, do not exactly accord with the written description and the claims. But drawings are to be taken as illustrative of the idea of the patent, not as working plans."

Plaintiff's expert (Vol. I, p. 448, Qs. 23 to 25) speaks from his own long experience to the same effect, and says that diagrammatic illustration, such as Figs. 12 to 12c, is usual in patent drawings. As an instance of similar lack of exactness, he points out (Vol. I, p. 448, Qs. 26 to 28) *one in defendant's patent* in evidence, wherein two sets of figures are totally irreconciliable as to the position of the shaft 115, and says that notwithstanding the more serious nature of the error, it was simply a draftsman's mistake, and not an irremediable one.

Spiral Gearing.

Defendant in the Court of Appeals below advanced still another alleged deficiency in the State disclosure, in respect to the gearing shown to rotate the core. It is also in large measure based upon the purely conventional

illustration and description, such as are ordinarily employed in connection with minor matters like gearing, the precise form of which is unessential because of the multitude of arrangements capable of producing a specified result. This was obviously the view of defendant in the *Firestone* litigation, wherein the subject was not even mentioned. The defense was so thoroughly demolished by plaintiff in rebuttal, that it is no longer relied upon, and hence will not be discussed.

Statement of Complete Mode of Action Unnecessary.

It is no argument against the merit of State's invention or the validity of his patent that the specification does not set forth in full every stage and every result of his procedure. For instance, the patent does not refer to the changes in the reticulations of the fabric, involving the formation of circumferential diamonds at the tread and radial diamonds at the bead. These were inherent in the type of carcass he was seeking to produce. But it does describe the mechanism for securing the two kinds of stretch, namely, the tension devices which retard the fabric with reference to the slow rotating core so as to stretch the tread zone circumferentially, and the advancing spinning rolls which are power-pressed against the fast rotating core so as to stretch the skirts radially. If the mechanism be thus recited, it is not necessary to enumerate its specific results.

So far as the general purposes are concerned, the specification is clear. For instance (p. 1, lines 57 to 61):

> "* * * Thereupon a pair of spinning-rolls by radial motion with respect to the ring-core gradually press the canvas in contact with the sides of the ring-core toward its internal periphery to shape the sides of the tire."

The effect of this pressing and shaping operation is to stretch the fabric radially and to produce the radial diamonds. Again it refers to the rolls in the following language (lines 65 to 70):

> "* * * The spinning-rolls are also radially movable with reference to the ring-core. They have been found peculiarly efficient in shaping the sides of the tire-shoe and form an important feature of my invention."

And then it proceeds to say that the rolls "are sharply differentiated from the hammers or sliding finger devices heretofore proposed for the purpose". This distinguishes State from Vincent who used the "hammers", and from Seiberling & Stevens who had the "sliding finger devices".

The specification details at great length the arrangement of the rolls in the matter beginning at line 93 of page 5 and ending at line 45 of page 6. This passage starts with the statement that "they revolve at high speed and exert considerable pressure on the fabric". It then enumerates various specific features, such as the provision of the handles on the arms; the springs, weights, or other devices for pressing the rolls against the core; the formation of the rolls with rounded edges so as not to cut the fabric and to secure effectual contact with it along the sides of the ring-core; the location of the rolls at a receding angle so as to obtain "a better forming action on the fabric"; etc., etc.

The core is described as rotated "say at two hundred seven turns a minute", a speed sufficient to produce the centrifugal effect, with the further statement that by this means "the machine not only does more work in a given time but *it does better work*". The description says (p. 6, lines 38 to 40) that "the centrifugal force tends to throw the fabric out at a right angle from the core-plane", and proceeds to explain that the receding

angle of the rolls prevents their entanglement with the fabric.

Other similar passages could be quoted, but without further elaboration there is unquestionably ample description to cover the devices which effect the ultimate result, namely, a rapidly rotating core upon the periphery of which the strip of fabric is applied and circumferentially stretched and by the rotation of which the skirts of the fabric are violently thrown out by centrifugal force to render them puckerless, wrinkleless and taut; spinning rolls for acting upon the outflung skirts of the fabric at their attached or hinged portions; hinged supports for the spinning rolls; power pressure means applied to the spinning roll supports for keeping the spinning rolls to their work under pre-regulated pressure; a radially sliding carriage running on fixed guides, upon which carriage the spinning roll supports are mounted, for compelling the traverse of the spinning rolls invariably in right lines; and means (the screw feed) for positively and regularly advancing the spinning roll carriage in its fixed path of movement, whereby the power-pressed spinning rolls are applied to the centrifugally outflung taut skirts of the fabric from the hinge portions toward the edges thereof in always advancing definite spiral lines of contact. When such is the case, a complete statement of the several steps and their resulting effects on the fabric may be omitted. The authorities are numerous.

A leading case is *Eames* vs. *Andrews*, 122 U. S. 40 (55):

> "It is to be observed that the scientific theory and principle, the application of which is supposed to constitute the invention of Colonel Green, are not set forth either in the original or reissued patents. This feature was commented upon by Mr. Justice Blatchford in *Andrews* v. *Cross*, 19 Blatchford, 294, 305, as follows: 'It may be that the inventor did not know what the scientific principle was, or that, knowing it, he omitted, from accident

or design, to set it forth. That does not vitiate the patent. He sets forth the process or mode of operation which ends in the result, and the means for working out the process or mode of operation. The principle referred to is only the why and the wherefore. That is not required to be set forth. Under § 26 of the act of July 8, 1870, 16 Stat. 201, under which this reissue was granted, the specification contains a description of the invention and of 'the manner and process of making, constructing, compounding, and using it', in such terms as to enable any person skilled in the art to which it appertains to make, construct, compound, and use it; and even regarding the case as one of a machine, the specification explains the principle of the machine, within the meaning of that section, although the scientific or physical principle on which the process acts when the pump is used with the air-tight tube, is not explained. *An inventor may be ignorant of the scientific principle, or he may think he knows it and yet be uncertain, or he may be confident as to what it is, and others may think differently. All this is immaterial, if by the specification the thing to be done is so set forth that it can be reproduced.*"

Diamond Rubber Co. vs. *Consol. Rubber Co.*, 220 U. S. 428 (435):

"* * * A patentee may be baldly empirical, seeing nothing beyond his experiments and the result; yet if he has added a new and valuable article to the world's utilities he is entitled to the rank and protection of an inventor. *And how can it take from his merit that he may not know all of the forces which he has brought into operation? It is certainly not necessary that he understand or be able to state the scientific principles underlying his invention, and it is immaterial whether he can stand a successful examination as to the speculative ideas involved. Andrew* v. *Cross*, 8 Fed. Rep. 269; *Eames* v. *Andrews*, 122 U. S. 40, 55; *St. Louis Stamping Co.* v. *Quinby*, 16 Off. Gaz. 135; *Dixon Wood Co.* v. *Pfeifer*, 55 Fed. Rep. 390; *Cleveland Foundry Co.* v.

Detroit Vapor Stove Co. (C. C. A., Sixth Circuit), 131 Fed. Rep. 853; *Vann Epps* v. *United Box Co.* (C. C. A., Second Circuit), 143 Fed. Rep. 869; *Westmoreland Specialty Co.* v. *Hogan* (C. C. A., Third Circuit), 167 Fed Rep. 327. He must, indeed, make such disclosure and description of his invention that it may be put into practice. In this he must be clear. He must not put forth a puzzle for invention or experiment to solve but the description is sufficient if those skilled in the art can understand it. This satisfies the law, which only requires as a condition of its protection that the world be given something new and that the world be taught how to use it It is no concern of the world whether the principle upon which the new construction acts be obvious or obscure, so that it inheres in the new construction."

The Grant Patent Litigation.

One of the authorities just cited, *Diamond Rubber Co.* v. *Consolidated Rubber Co.*, 220 U. S. 428, seems to merit individual discussion because of its close parallelism in many respects to the present circumstances. It is a leading case on the point that the correct principle and mode of action of a patented mechanism need not be set forth in the specification. It holds that "the law has other tests of the invention than subtle conjectures of what might have been seen and yet was not." Again, it says, "Nor does it detract from its merit that it is the result of experiment and not the instant and perfect product of inventive power." The reading of the opinion will develop numerous points of docrine that confirm plaintiff's contentions.

This case was the climax of protracted litigation and finally came before this Court by *certiorari*, because of diversity of holdings in different circuits. The Grant patent was for a tire of solid rubber provided with retaining wires, in combination with a vehicle wheel, the tire and wheel being formed in certain specified ways so

as to co-act with each other. Without detailing the long list of cases in which it was involved, and which are stated at the outset of the opinion, it may be noted generally that the patent was invalidated by the Court of Appeals in the Sixth Circuit, and by one or more courts in other circuits following its opinion. It was then sustained by other courts, notably by the Court of Appeals in the Second Circuit, and ultimately came up to this Court. Briefly stated, the Courts in the second circuit held the patent valid, because the tire possessed a certain *tipping* capacity. This Court said:

> "This tipping capacity is made the pivot of the controversy. It was as to that that the courts of appeals of the sixth and second circuits disagreed either upon the difference of the testimony in the cases, or more deeply, on principle. The controversy and Grant's alleged ignorance of the tipping characteristic of the tire really present some anomaly. The tire has utility, a utility that has secured an almost universal acceptance and employment of it, as will subsequently appear. It was certainly not an exact repetition of the prior art. It attained an end not attained by anything in the prior art, and has been accepted as the termination of the struggle for a completely successful tire."

And the opinion proceeds to detail other points which closely resemble those at bar, including the requisites of invention, commercial success, infringement, and failure to anticipate by prior tires which seemed close from a superficial standpoint. If another point should be emphasized, it is that this tipping capability, on which the patent was sustained, was nowhere mentioned in the specification, and was first discovered in the commercial employment of the tire. If still another specific feature is to be made prominent, it is that this Court upheld the several courts of the second circuit in their refusal to be bound by the finding of the Court of Appeals in the Sixth Circuit.

Goodyear Machines.

Like the machines furnished to the licensees, those in the Goodyear plant correspond to the showing in the patent in suit, and the same is true as to Plaintiff's Exhibit No. 2, as testified to by plaintiff's expert (Vol. I, p. 40). The statement is made in connection with the theory of defendant's expert that in the patent the rolls do not press the fabric against the core. As already shown, the specification itself negatives any such theory, and State has testified that he never heard or knew of any such mode of operation (Vol. I, p. 328, Qs. 202, 203).

There are of course some differences in the details in these commercial machines, but none of them affect the subject matter at bar (Vol. I, p. 80, x-Q. 164). Defendant's expert discusses them, and admits (Vol. I, p. 232) that the spinning-rolls do not rest in bights or loops of the unapplied fabric but pinch or compress it against the core. The principal distinction he dwells on is that the roll 36 is slightly barrel-shaped rather than cylindrical and thus tends to shape or preform the fabric; but as to this plaintiff's expert testifies (Vol. I, p. 458, Q. 42) that this is the case only in a minority of the machines he inspected, and that even then the departure from cylindrical form is so slight as to require critical attention to observe it, and is intended merely "to keep the fabric running straight", and that there is no shaping of the fabric thereby.

With regard to the quality of work, both Browne and Ray testify that it is of high grade. In view of the fact that sixty millions of tires have been made on these machines, they seem good enough to meet the requirements of the trade.

Defendant, in its brief (p. 110), refers to the photographs of the Goodyear machine (Vol. II, p. 191) as showing the presence of puckers in the skirts of the fabric.

Defendant does not state, however, as it is so careful to do in connection with the photographs of the Belgian Model, that these photographs were taken while the machine was still. Nor does defendant mention the fact that the fabric plies have not as yet been wrapped around the beads in the finishing operation. *It is interesting to note that the photographs do not show puckers or wrinkles in any part of the fabric upon which the spinning rolls have acted.*

Alleged Aggregation.*

As already discussed, the claims in suit (except 12 and 13) are confined to the combination of the high speed power-driven core that functions to violently fling out and outstretch by centrifugal force the skirts of the fabric so that they shall be puckerless, unwrinkled and taut, with mechanically guided, power-pressed, mechanically advanced spinning rolls, that effects the radial stretching of the meshes of the fabric through the bead zone of the tire. There is a reference to "a sheet-fabric supply", but no mechanism for supplying the fabric is included. As the purpose of the forming-rolls is to act on the sheet fabric after it has been preliminarily placed on the core, it is eminently proper that the fact be referred to, and the quoted expression does no more than this. It may also be noted that this particular language was introduced by amendment into the claims for the purpose already mentioned, viz., to indicate that the spinning-rolls were designed to operate on sheet fabric.

Claims 12 and 13 are in a somewhat different category, in that in addition to the final operation by the forming-rolls of shaping down the fabric on the side of the core when it is rotated by the fast-speed mechanism, they also include the initial step of stretching the sheet-fabric from the stock-roll on the core when actuated by

* Defendant is apparently no longer relying upon this defense.

the slow-speed mechanism. In other words, these two claims set forth the complete machine construction, including the stock-roll, both the high-speed mechanism and the low-speed mechanism, and speed-changing mechanism, so that either speed may be availed of.

The Court of Appeals for the Sixth Circuit held in effect that claims of this description, involving sequential operations, were aggregation and not combination. In support of this position it cited *Gas Co.* v. *United Co.,* 228 Fed. 684, one of its own opinions. The subject matter there was apparatus for making water-gas, which was provided with a gauge, and certain valves to be manually operated. When the gauge indicated a certain condition, the attendant would operate one or other of the valves. As the opinion states:

> "* * * The gauge gave notice to the operator that he should do something, and then its function was finished until it again gave him similar notice."

Of course, there was no combination in this. But the facts here are totally differentiated. The State construction embodies an organized machine, with two speed mechanisms, one to effect the original or circumferential stretching, and the other the second or radial stretching, and is further provided with a speed-changing mechanism whereby either speed may be called into action at will.

A much more pertinent Sixth Circuit case might have been selected by the Court of Appeals, namely, *National Tube Company* vs. *Aiken,* 163 Fed. 254, involving patent 450,360 for Mechanism for Conveying and Cooling Metal Plates. A typical claim of the patent involved reads as follows (55 O. G. 213):

> "As a means for conveying and cooling metal plates, the combination, with rolls adapted to roll metal plates, and the rolling mill feed table, of conveying tables, one of which is situate adjacently to and is independent of the feed table and is adapted

> to receive the metal plates therefrom, and transfer mechanism adapted to transfer the plate from the first table to the next, substantially as and for the purpose described."

It was objected that this and other claims of the patent were for mere aggregations. This contention was overruled. Judge Lurton, who wrote the opinion, observed (p. 262):

> "The argument that the straightening press does not act simultaneously with the other devices included in the combination, if true, is not enough to defeat the patent. If that device is so arranged with the other devices made elements in the combination as that each part co-operates to produce a single practical and beneficial result, it is not important that that final result shall have been produced by a simultaneous or successive action of the combined elements."

The Court of Appeals for the Third Circuit, in this case, considered the defense of aggregation and disposed of it favorably to the plaintiff, citing authorities, which it is not necessary for us to here repeat.

Some of the pertinent decisions of this Court will be found on page 171 of the brief.

Emphasis is laid on the fact that even were defendant's contentions and objections as to the other claims well founded, and no such admission is made or contemplated, they would not apply to claims 12 and 13, which set forth the entire machine construction in the manner approved by the Courts. Defendant has largely based its case on the theory that State's claims now are in effect for a method which is anticipated by hand spinning. Obviously this theory falls to the ground in connection with claims 12 and 13, which present the entire coordinated mechanism whereby both the original circumferential stretching and the subsequent side-forming

action are secured. In hand spinning there was no mechanism for rotating the core at slow speed to produce circumferential stretch; there was no mechanism for rotating the core at high speed to obtain the centrifugal effect; there was no core-rotating mechanism of any description; there was no speed-changing mechanism; there was no radially moving support laterally pressed against the core; there was no mechanical means for forming the skirts of the fabric to the sides of the core; and there was even no stock-roll from which the supply could be drawn. All of these parts are covered in claims 12 and 13 and meet the test laid down by the Courts, i. e., they effect "a new unitary result, to the production of which the different elements co-act".

The Infringement.

Defendant's machine is disclosed in U. S. Letters Patent No. 1,119,326 of Thropp *et al.* This is agreed on by the respective experts. Each uses the drawings of the patent in describing the construction of the Thropp machine. The particular form complained of is that disclosed in Figs. 14 and 15 of the drawings. In the remainder of the illustration, the forming-rolls are shown as driven by electric motors, this being the only essential difference. In defendant's machine, and as illustrated in Figs. 14 and 15, the rolls are driven by contact with the fabric on the side of the core, exactly as in the State patent.

One of these machines has been introduced in evidence, as Defendant's Exhibit T, and was exhibited to plaintiff's counsel and expert prior to the beginning of testimony. This exhibition sufficed for plaintiff's *prima facie* case, although the machine was operated in a carefully selected manner so as to differentiate it from State as far as possible. Even then it clearly infringed. It will be later shown that the *actual* mode of operation, the

one followed in *commercial* practice, is quite different from that arranged for the purposes of the exhibition, and closely parallels that of the State machine.

Plaintiff's expert describes defendant's machine at length at Q. 9, Vol. I, pages 41 to 46, for convenience largely referring to the Thropp patent. In the machine itself, the high speed was 125 R. P. M. and the low speed one-tenth of that. At the low speed the flat fabric passes from the supply roll about suitable tension and guiding devices and is stretched circumferentially on the core at the tread zone. This is the first step of the double stretch system. The core is then rotated at high speed and the outflying skirts are acted upon by the forming-rolls, which are mounted on pivoted levers, the levers in turn being carried by a suitably guided carriage. The carriage is fed inwardly by a screw, and this screw may be operated manually by a hand wheel or mechanically by power. In the exhibition of the machine the screw was turned mechanically. *In commercial use the screw is turned manually, as in the State machine.* The forming-rolls are pressed inwardly by weights instead of by springs. It will be remembered that State specifies the alternative use of weights and says that he includes both weights and springs in his claims. As the core rotates rapidly, and the carriage is advanced, the rolls are pressed upon the skirts of the fabric at the hinge line, exactly as in State and with the same result, namely, the skirts being thrown outwardly by centrifugal force, and the rolls being fed gradually inward, each traces a spiral path upon the fabric and acts upon small areas thereof to fold them down at the hinge line and cause them to adhere to the core. Each forming-roll has a rounded working edge, and each is set at a receding angle to the plane of the core. The result of this is to stretch the fabric and to elongate its reticulations radially. This constitutes the second step of the double stretch sys-

tem. A comparative sketch of the two machines is here provided.

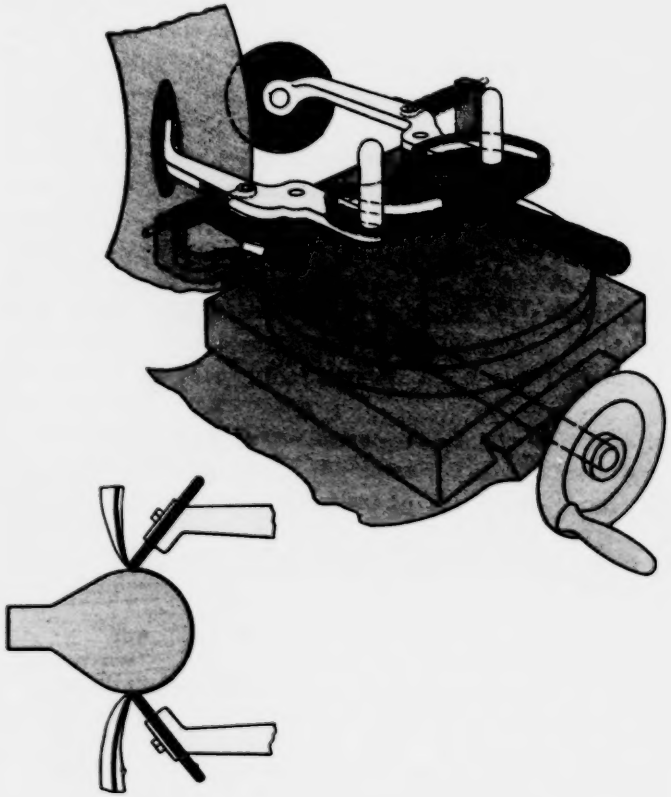
Mechanically considered (Vol. I, p. 44), in each machine there is a core, a low-speed mechanism, a high-speed mechanism, and speed-changing mechanism. There is a stock-roll for the flat fabric and tension mechanism between the stock-roll and the core. There are two forming-rolls which simultaneously act upon the opposite sides of the core and against the hinges of the skirts. Each forming-roll is carried by a swinging arm and is forcibly pressed against the fabric, by a spring in one case, and by a weight in the other. The sliding carriage which carries the rolls is mechanically mounted and accurately guided, and is fed by a screw so that it may be gradually advanced. Each roll has a rounded working edge and each is set at a receding angle with respect to the core plane. In each machine the fabric skirts are held stiffly and smoothly and without wrinkles away from the core by centrifugal force and under sufficient tension to produce radial stretch when acted upon by the rolls.

The mechanism is the same. The mode of action is the same. The result is the same. The elements present are exactly those specified in the State claims in suit.

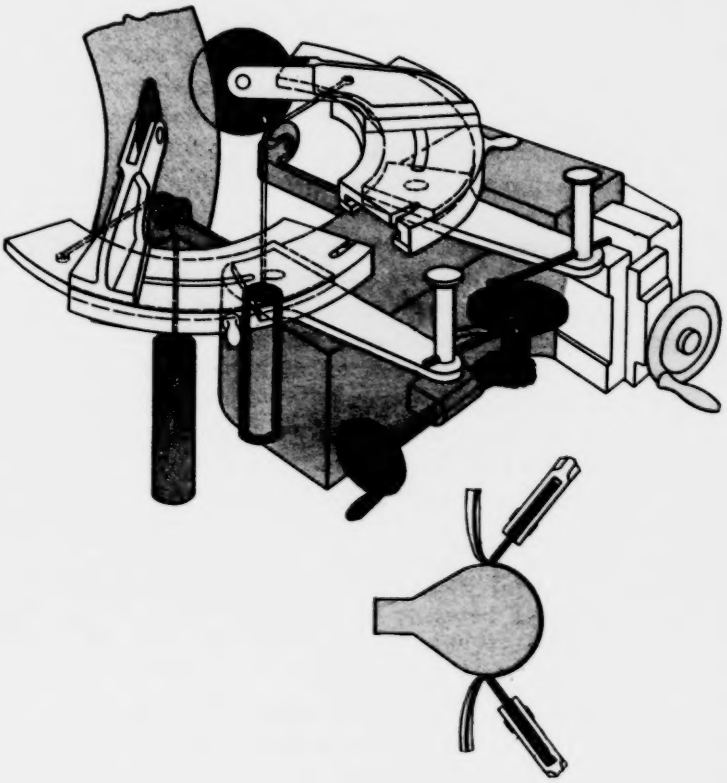
The Court of Appeals below disposed of the matter as follows:

> "The question of infringement is confined to a narrow limit. The essential elements of State's machine are found in the defendant's machine. We have the rapid rotation of the core. We have the loose edges, stretched by the centrifugal force induced by rapid core rotation. We have a radially moving tool support, and those tools laterally power-pressed not by the spring of State's machine, but by a weight which functions in the same way to bring the spinning rolls into one continuous shifting play, and the whole machine devised to adapt and combine

State's Machine



Defendant's Machine



in the same mechanical way State disclosed, the use of spinning rolls, co-operating with centrifugal radial stretch of the fabric to produce the unitary machine-made product, which State first made possible in the art."

Among the immaterial differences noted by plaintiff's expert (Vol. I, p. 46, Q. 10) are the following: The stock-roll is mounted above the core and is vertically adjustable. There is no tread roll. There is an automatic feed for the carriage in addition to a hand feed. There is an automatic stop motion for the carriage advance. There is an adjustable pointed gauge. The forming-rolls are mounted on supporting plates which are adjustable with reference to the supporting arms. The arms are provided with means to which they may be connected at will so that the rolls may be swung away from the core and whereby also the workman may press them against the core. There are no bead forming-rolls. The trimming cutters are mounted on an independent frame. There are special detachable bead rings. The forming-rolls are greater in diameter than those shown in the State patent, etc., etc. It will be readily seen that none of these changes is material, although defendant alleges them to be improvements.

"But advance beyond, or even improvement upon, a patented device does not cease to infringe, so long as the combination of the patented device is itself utilized in the advance." *Hess-Bright* v. *Fichtel*, 219 Fed. 723."

Defendant's position. There is no substantial denial of plaintiff's statements as to the construction and mode of operation of defendant's machine, as above stated. In addition, there is the admission by defendant's expert that it comprises mechanism for performing the double stretch method (Vol. I, p. 271, Q. 62):

"* * * It has means for exerting a regulated tension on the fabric to stretch it to shape. It has

spinning-rolls mounted to move radially and to be fed automatically, to spin the fabric against the core."

He endeavors, however, to differentiate along the lines of the exploded theories already discussed, and first he alleges that there is in the Thropp machine mechanism for obtaining a considerable circumferential stretch, and to this end he quotes from the Thropp patent (p. 5, line 30):

> "As the shaft 8 is rotated, it will, in turn, rotate the core 104 drawing the friction fabric off of the stock roll 66, and stretching the latter tightly about the periphery of the core 104. *It will be seen that* in preparing for this operation, *the resistance on the roll 68 may be varied so as to get exactly the desired amount of stretching* in the friction fabric on the periphery of the core; *and that this stretch or tension will be exactly uniform throughout the circumference of the core*, and may be much greater than that possibly attained by the strongest operative."

But this quotation from the Thropp patent is of small import since it affirms nothing more than is stated in the patent in suit. For instance State says (p. 2, line 121):

> "* * * *If increased tension is desired* on the tension-roller 36 *the turnbuckle 47 is manipulated* so as to cause a contraction of the friction band 43 on the disk 42 to a determined degree, indicated by the gage 46 *so that a predetermined amount of resistance will be offered* to the turning or movement of the tension roller 36."

Also (line 107):

> "* * * The tension-roll constitutes a highly important element since *it secures the application of the several layers of fabric to the ring-core with a uniform degree of tension.*"

By comparing these two sets of quotations from the Thropp and State patents respectively, it is difficult to see that any different mode of operation or result is contemplated.

Defendant's expert then proceeds to discuss the adjustable mounting of Thropp's forming-rolls so that they may be shifted with respect to the supporting arms to vary their angle with respect to the core. This difference is immaterial as to most of the claims in suit, but will be discussed again in reference to the term "receding angle" employed in several of them.

He next refers to the fact that weights instead of springs are used to force the rolls against the core. Even if this arrangement be an improvement, it is immaterial, and particularly when it is remembered that the State specification refers to the use of weights as equivalent to springs.

He mentions the mechanical means actuating the screw to advance the rolls radially. This is also an immaterial improvement, and it is again noted that in the commercial use of defendant's machines the screw is turned manually, just as in the State machine.

He also refers to other differences already pointed out by plaintiff's expert, which need not be discussed again.

Briefly summarized, the contentions of defendant's expert, in his endeavor to deny infringement, are as follows: (1) that defendant's machine is more automatic than that of State; (2) that defendant's rolls press the fabric against the core and that this is not the case in the State machine; (3) that defendant's carriage is advanced mechanically and not manually; (4) that defendant's rolls are not set at a receding angle; (5) that defendant's means for pressing the rolls against the core are different; and (6) that defendant's machine embodies the single stretch instead of the double stretch system. These several points will be treated separately.

Automaticity. The claim that the Thropp machine is automatic as compared with the State machine, is wholly without merit and is fully discussed by plaintiff's expert beginning with Q. 9, Vol. I, p. 437, to which reference may be had if required. In Q. 11 he compares in detail the sequence and number of manual operations necessary in the two machines and points out that there are actually more hand manipulations in defendant's machine than in that of State. The principal feature involved in this alleged automaticity is the mechanical actuation of the feed screw, which will be discussed under a separate heading.

The Courts have sustained many patents on devices involving hand control and manipulations. A leading case is *Bates* v. *Coe*, 98 U. S. 31, in which the mechanism in suit involved a number of hand operations. For instance, there was

> "Bevel gearing for driving a shaft or spindle *propelled by manual power, capable of running at two speeds*, and arranged so that the operator *who turns the crank* can properly adjust and attend to the material and cause the several parts of the machine to work harmoniously."

It will be noted that in some respects the parts described are akin to those of State. Again, there were

> "*Automatic and hand-feeding devices*, so arranged to the machine as to be easily controlled by the operator, to give vertical motion to the spindle when used for drilling."

There was also

> "A shaft or spindle for holding the tool for performing the work, constructed and arranged in the machine so that it may be fed *automatically or by hand*, or by both, and so connected by a pinion to the crank that it can receive rotary motion independent of its vertical feeding motion, by means of which it is enabled to act as a screw cutter."

Certainly lack of automaticity did not affect this Court in that case.

As Judge McPherson said in *Burdett Co.* v. *Elevator Co.*, 196 Fed. 43, 46:

> "The successive operation of the signals and of the motor is not a decisive objection; and the necessary intervention of human agency is equally unimportant. A device need not be wholly automatic before it can be protected by a patent, nor need all its movements be simultaneous. 'The test is whether there is a new unitary result, to the production of which the different elements co-act.' "

There are numerous authorities of similar import, a principal one being *Krell* v. *Story*, 207 Fed. 946, which discusses the question of human intervention at length and refers to numerous cases.

Defendant's "bight" theory. This point is to the general effect that in the State machine the rolls do not press the fabric against the core but are held away from it by centrifugal force in the folds or bights of the skirts. In an earlier chapter (p. 100), we have shown that it is entirely without foundation, not only by the testimony of several witnesses, but also on the numerous positive statements in the State specification to the contrary effect. It is beyond question that the action is precisely the same in the machines of both plaintiff and defendant.

Mechanical advance of carriage. In defendant's machine, the carriage is guided on a slideway, just as in the State machine, to ensure the uniform and accurate advance of the rolls on the sides of the core. In the State patent the means employed for moving the carriage comprise a screw and a hand wheel which is manually operated by the workman. In the Thropp patent there is a

similar screw and hand wheel, and in addition there are connections whereby the screw may be turned by power; either means may be employed at the will of the operator. Defendant's expert lays great stress upon the advantages in the mechanical operation. It is largely if not entirely upon this capability that he bases his claim that defendant's machine is automatic. In the carefully prepared demonstration of the Thropp machine, intended for the purposes of this litigation, the screw was rotated by power. While it is quite immaterial whether it be turned by hand or by power, it is interesting to note that in the actual and commercial use of defendant's machines the hand wheel, and not the power mechanism, is employed.

In order to investigate and settle this question, Ray (Vol. I, p. 562, Q. 105 *et seq.*) visited four tire factories using defendant's machine. They were the Lee factory at Conshohocken, Pa., the Racine factory at Racine, Wis., the Zee Zee factory near Trenton, N. J., and the Ajax factory at Trenton, N. J. Moreover, these four plants were the *only* ones he visited, so there can be no suggestion as to the suppression of unfavorable observation in other factories. The Thropp machines at these four places (Q. 109) were similar to that in evidence in respect to the devices here in controversy; and in each of these four factories (Q. 113), "the slide carrying the stitcher arms was *advanced manually in all cases*, the operator turning the hand wheel mounted upon the screw which feeds the carriage inward". This commercial practice, which is parallel to that of State, completely demolishes the claims advanced by defendant's expert as to advantages involved in the mechanical operation of the screw.

The receding angle. Defendant's expert states at several places, for instance, on page 275, Vol. I, that in the Thropp machine the rolls operate "substantially at

right angles to the surface of the core at all points and not at a receding angle". The allegation, even if correct, would affect only a few of the claims in suit, the others not being limited to the receding angle feature. But it is not correct. In the exhibition of its machine, and to make out the best case possible, defendant used the rolls at a receding angle (Vol. I, p. 72, x-Q. 119) until they "reached the maximum width of the core and began to move inwardly", when the workman adjusted them to a perpendicular condition. Even this would meet the terms of the receding angle claims, giving defendant the full advantage of its special demonstration. However, the rolls in actual commercial practice are employed *throughout* at State's receding angle, and defendant's patent indicates were intended to be so employed.

There is no doubt what the patent in suit means by the term "receding angle". The specification defines it at page 6, lines 33 to 36:

> "* * * It will be noted finally that I mount the spinning-rolls with their plane not at a right angle to but to recede at an acute angle from the plane of the ring-core."

And it is shown in Figs 12^b and 12^c of the drawings. When this position is compared with that shown in Figs. 14 and 15 of the Thropp patent, it will be seen that the term means exactly the same in both cases, and it will also be seen that the rolls may be "at right angles to the surface of the core" and still be at a receding angle to the plane of the core. This is fully understood and realized in the Thropp patent, as even in its claims (for instance, 12 and 13) the forming-rolls are described as "arranged to engage the core at an angle to the plane thereof". There can be no doubt as to what defendant's intentions were.

And this intended angular inclination of the rolls is supported and confirmed by their actual use in commer-

cial practice. Ray testifies (Vol. I, p. 564, Qs. 114 to 116) that in all four factories the rolls stood at this receding angle to the plane of the core, "*during the whole time* that they were acting upon the fabric upon the sides of the core"; and that this angle "was not changed during the advance of the rolls". They were afterwards adjusted to a different angle to go about the bead, when the latter was placed over the already applied fabric, but that is immaterial to the facts under consideration. The commercial practice in forming the fabric to the sides of the core is exactly parallel to that of State.

In the earlier litigation, the Court of Appeals for the Sixth Circuit pointed out at length that the Firestone machine did not embody the roll at the receding angle as defined by State, and that it was really employed in a skewed position; what it meant may be more easily illustrated than described, and for that reason attention is directed to Plaintiff's Exhibit No. 13 (Vol. 2, p. 108), Fig. 2 of the drawings near the middle, wherein the roll 133 is shown in such a skewed position. In the present case, *the roll of the Thropp machine, and particularly in its commercial use, is set and employed in precisely the same way as that of State.* The Court of Appeals for the Sixth Circuit substantially admitted

> "that in State's particular form of device with his spinning disc at its 'receding angle', and practically tangential to the core circumference at the point of contact, there will be enough 'hinging and folding' back over his tool to produce a friction which would cause more stretch than could the mere rolling advance of the disc in its helical path."

Roll pressing means. Defendant's expert also lays stress upon the fact that the means defendant employs for pressing the rolls against the core are different from those in the State patent, referring more particularly to the use of weights in place of springs, and to

the arrangement whereby the arms may be connected to a hand wheel and thus be forced in positively.

Ray observed the prior devices in the four factories he visited, and found that the method of employing them was different from that given by defendant in the special demonstration of its exhibit machine. *In three* of these plants (Vol. I, p. 565, Q. 118), Lee, Zee Zee, and Ajax, *the weights were employed to pull the forming-rolls against the sides of the core*, although the pressure was controlled manually by the operator, who could either increase or diminish it at will. This manual control is the same as that disclosed in the State patent, which, as before mentioned, provides the arms with the handles 142. The more complicated arrangement in the Thropp machine serves the same end, although it is questionable if it may be regarded as an improvement. But whether or not, the question is of no importance. As a matter of fact, hand-controlled devices are not referred to in the claims in suit.

In the fourth factory, Racine, the weights had been removed and *the arms were pressed against the sides of the core by springs* interposed between the disc and the outer ends of the arms. Here the operator controlled the compression of the springs by the hand wheel, but the final and effective pressure was given by the springs.

In other words, in commercial use *defendant's rolls are pressed against the core by either weights or springs*, which are subject to hand control, and the same was true even in the special demonstration of the Thropp machine. There is no possible escape along this line. *The State specification is explicit in saying* (p. 6, lines 9 to 11) *that he may use "not only springs and weights but other mechanical instrumentalities for pressing the spinning-rolls against the ring-core"*, with much more to the same effect.

Stretch contention. Defendant's expert also makes an unavailing effort to escape by the allegation that in the Thropp machine the fabric is so greatly stretched circumferentially as to require little or no subsequent side-forming action by the rolls. This theory is met by the customary obstacle of hard fact. The contention in substance is that Thropp operates on the single (circumferential) stretch system, as distinguished from the State double (circumferential + radial) stretch system. For instance, he says (Vol. I, p. 273):

> "It thus appears that the fundamental idea of means upon which the Thropp machine is built is that of stretching the fabric so greatly at its centre as to very largely effect thereby the shaping of the fabric to the core."

He endeavors to support his presumption by extracts from the Thropp specification. These we have previously discussed and have set against them similar extracts from the State specification. Contrasting the two, it would appear that the intentions of the two patentees were the same.

Moreover, his theory is positively contradicted by the evidence of defendant's own witness, Curtis, who is an employé of one of the Thropp Companies at Trenton, his duties being to demonstrate the Thropp tire machinery and equipment. He testifies (Vol. I, p. 299):

> "x-Q. 66. What is the normal amount of stretch employed in originally attaching the ply to the core, in connection with the Thropp machine?
>
> A. We are using about *twelve per cent.* as a standard now."

He also says that the amount of stretch varies widely according to the particular company; but the *standard* is twelve per cent., which is exactly the same as the standard in the State machine, as already stated. This

testimony alone is sufficient to dispose of the single stretch contention.

Defendant's expert becomes further enmired as he proceeds. It is to be remembered that when the double stretch method is employed, there are radial diamonds in the bead portion, which is not the case when the single stretch system is used. He says (Vol. I, p. 279), in reference to defendant's machine, that he has "*never seen or been able to ascertain from anyone else that there is any distortion of the fabric meshes on the sides into diamonds having the longest dimension radial*", and that while he finds the elongation of the meshes on the tread due to stretching, he does not find "any radial elongation at any portion of the fabric." Incidentally, he does not say what tires he has examined, nor are any introduced in evidence, and as will appear later, he was not taken into the confidence of his client.

This alleged absence of radial diamonds he contrasts (Vol. I, p. 283, Q. 73) with the condition he saw in the fabric formed upon the core of State's first machine, Plaintiff's Exhibit No. 2, wherein he says that "in the portions of smaller radius the meshes appeared to have taken a diamond shape with the long axis radial. The change of form was slight but perceptible." In both the State and the Thropp machines, sufficient tension is applied to stretch the fabric circumferentially, and in the commercial use of both of these machines, an initial stretch of twelve per cent. is effected, after which the skirts are radially stretched by the rolls with the necessary production of radial diamonds. Plaintiff's expert (Vol. I, p. 72, x-Q. 117) says that the operation of the Thropp ring-core and spinning-rolls would necessarily produce the same result as in the Goodyear machine. But the proofs far transcend any such conclusion, however accurate it may be.

Ray made a special point of investigating this matter at the time of his visits to the four factories using the

Thropp machine. He says (Vol. I, p. 566, Qs. 119 to 124) that he observed the fabric as it was laid upon the side of the core and carefully noted its condition, and that he paid particular attention to the reticulations of the fabric in relation to radial diamonds. *Ray* (Q. 122) *actually saw, in each of these four factories, diamonds in the bead portion with the long dimension radial, and says that these radial diamonds were readily perceptible. This evidence, based on actual observation, completely offsets that of defendant's expert.* But that is not all.

Ray further testifies (Vol. I, p. 566, Qs. 125 to 133) that he *purchased on the open market* one of the tires of each of the concerns mentioned, viz., *Lee, Zee Zee, Ajax, and Racine*, and these *four tires have been introduced in evidence* as Plaintiff's Exhibits No. 30, No. 31, No. 32, and No. 33. He says (Q. 129) that *in all four* of these exhibit tires *there are diamonds with their long axes radial in the bead portion;* and to make this apparent he has removed certain outer portions of the tires, and has outlined the diamonds in pencil to make their angularity more appreciable to the eye. Of course, each individual diamond is small, but the pencil marks following the crossing threads clearly indicate their angular relation to each other.

These four tires are the only Thropp-made tires in the case. Defendant introduced none, and for obvious reasons. If they had been produced by circumferential stretch alone, there would be squares in the bead portion, as in the illustrative specimen, Plaintiff's Exhibit No. 34, previously mentioned. Apart from theory or speculation, the tires themselves demonstrate the use of the double stretch system exactly as in the first State machine and exactly as in the subsequent commercial machines.

Defendant's patent. In addition, the Thropp patent is conclusive as to the intention to embody double stretch in defendant's machine. After describing the

original or circumferential stretch, it says (p. 5, lines 59 to 63):

> "the disk forming rolls 132 engage the friction fabric on each side of the core at *about the point where the fabric ceases to show its stretch due to the previous action of drawing it on the core.*"

Then it describes the action of the rolls on these unstretched portions, when it proceeds (p. 5, lines 85 to 91):

> "* * * After the first sheet of fabric has been thus *formed* completely about the core by the *stretching* and about the *sides* of the core *by the disk forming rolls*, a second sheet of fabric may be drawn onto the core in a manner precisely similar to that already described."

And it refers to the operation on this second sheet as follows (p. 5, lines 106 to 111):

> "* * * After this second strip has been thus stretched on the periphery of the core superposed on the first strip of fabric, *it may be formed down about the sides of the core by the disk forming rolls 132 as previously described.*"

There is much more to the same effect, but enough has been quoted to indicate that the skirts of the fabric are formed to the sides of the core in the same way as in the State machine, and to refute the expert theory that circumferential stretching alone is employed.

The only difference between the disclosures of the two specifications is that defendant's patent refers to "forming" the fabric on the sides of the core by the rolls, while the State patent refers to the same action as "shaping" the fabric on the sides of the core.

Even the Thropp claims indicate the similarity of operation. There are 148 of these, and in them the rolls are referred to as "rolls", "elements", "devices", etc. In

145 of the 148 claims, the rolls, however identified, are stated to be for "forming" the material on the sides of the core, or the like; and in the other 3 claims the language is substantially equivalent. In 31 claims the rolls are recited as "forming-rolls", and in 43 claims as "forming elements". 34 claims refer to the initial stretching, and then attribute the "side forming" action to the rolls.

By way of comparison, in each of the State claims in suit, Nos. 4, 5, 6, 7, 22, 23, 24 and 25, the rolls are described as to pass "radially along the sides of the tire-shoe to shape the sheeted fabric on the core," or in language of similar import; and in claims 12, 13 and 26, they are described in substantially the same way.

Thus, in addition to the proved facts, precise similarity of function is asserted and described in the specification and claims of both plaintiff's and defendant's patents. There can be no doubt of the use of the double stretch system in each machine. There is no foundation for the alleged use of the single stretch method in defendant's machine. Further, many of the claims of the Thropp application when pending in the Patent Office were rejected on the State patent, even though the application was for a supposed improvement, as will be apparent from a review of the official actions in its file wrapper, Plaintiff's Exhibit No. 15. This indicates that the Patent Office also realized the closeness and pertinence of the earlier State structure to that of Thropp.

In parallel circumstances, when comparing the patents of plaintiff and defendant, respectively, the Court held:

> "As already stated, both the Quinn and the Ames patent do the same work in substantially the same way, and achieve the same result. The same principle is apparent in both, and is worked out on the same lines. When this situation is disclosed, infringement is disclosed." *Refrigerator Co.* v. *American Co.,* 171 Fed. 416.

Core speed contention. Defendant makes the argument that the Court should not permit the speed of rotation of the core to be taken as a determining element. The proofs already reviewed show that below 80 R. P. M. State's beneficial effect is not attained, whereas it is attained at 120 R. P. M. There is no dispute about this. But defendant says that it would be wrong to say that a machine infringed at the higher speed if it did not infringe at the lower one. *To which the answer is that the proofs also show that defendant employs the higher speed and not the lower one. Nor is there any indication by defendant that it is willing to employ the lower speed, and for the obvious reason that the machine would then be useless.*

It might be contended just as logically that a patent on an aeroplane or a hydroplane could not be infringed because its motor might be driven at a speed lower than that required to make the plane fly; or that a patent on a high tension electrical apparatus could not be infringed because it might be uselessly employed with a low tension current. Illustrations of this general character may be multiplied almost indefinitely.

Nor is this the first time that high speed has been important in a machine combination, as for instance in cream separators, gyroscopes, centrifugal casting machines, centrifugal oiling systems, and the like, in none of which the apparatus would be useful at low speed. In a comparatively recent case, *Ottumwa* vs. *Christy*, 215 Fed. 362 (C. C. A., 8th Cir.), involving an apparatus for loading coal into cars, the older devices were dispensed with and in place thereof was substituted a carrier *"moving at great speed"* which caught the coal and *threw it by momentum* to its destination. The high speed carrier was "the chief element" of the arrangement. The opinion states (p. 369):

> "It is claimed that Christy's combination and these claims are anticipated by the prior state of the

art. It is not claimed, and it is probably not true, that any of the mechanical elements of which Christy's combination is composed is new, and this, like most modern patents, is a patent for a new method of combining old mechanical devices. But a new combination of old elements, whereby a new and useful result is produced, or an old result is attained in a more facile, economical, and efficient way is as securely protected by a patent as a new machine or composition of matter."

Again it says (p. 374):

"The defendant has not omitted to make another attack upon Christy's combination, which is generally made upon every patented combination, and that is that it is a mere aggregation of old elements and not a combination subject to patent. It is true that there is no invention in the mere assembling of old elements into an aggregation in which each element performs its own independent function only and in which no new principle or mode of operation or new result is produced. But Christy's combination of elements was new; it was not disclosed in the prior art; no one had ever made it before him. The independent functions of his various elements were modified and extended by his combination so that together they operated on a new principle and by a new mode and produced a new and better result."

Other Defenses.

The two alleged anticipations principally relied on by defendant are the prior practice of hand spinning and the Mathern Belgian patent. The first of these has been treated early in the brief. The second will presently be discussed. It seems desirable first to dispose of a few other patents set up by defendant.

Minor Defenses.

Several patents are presented by defendant's expert, although it is believed rather as indicating the state of the art than by way of anticipation. These will be briefly discussed.

Hernandez patent. The French patent to Hernandez, Defendant's Exhibit P (Vol. 2, p. 313), was granted January 8, 1909, and published March 19, 1909. Quite apart from the fact that its subject matter is not relevant, it is not early enough in point of time, as State's first commercial machine was set up and used in the spring of 1908.

Mathern German patent. This German patent, Defendant's Exhibit O (Vol. 2, p. 305), was filed December 20, 1906, but is stamped *Ausgegeben* January 26, 1909. In addition to its lack of pertinence otherwise, it is too late in date.

Vincent patent. The Vincent U. S. patent No. 794,473, Defendant's Exhibit J (Vol. 2, p. 245), has been already mentioned on page 15. Defendant's expert admits that it proceeds along the single-stretch system. He says (Vol. I, p. 254, Q. 43):

> "It differs however from the Mathern machine or the State machine in that it has only one speed. This is because it stretches the fabric so nearly to the final shape that spinning rolls are not necessary."

After the fabric is thus pre-formed by circumferential stretching, it is applied and cemented by little hammers that pat it against the sides of the core. These hammers (Vol. I, p. 482, Q. 69) are arranged at different distances from the axis and have no radial movement. They do not

stretch or form the fabric in any way. There is no outflying of the skirts (Q. 70) for two excellent reasons,—in the first place, even if there were centrifugal force, the hammers would prevent it, and in the second place, the speed is too low to cause centrifugal force. The hammers do not effect any change in the fabric reticulations. All this had been attended to in the original stretching.

Seiberling & Stevens patent. The U. S. patent to Seiberling & Stevens, Defendant's Exhibit K (Vol. 2, p. 257), has already been discussed at length, as the one under which the Goodyear Company began its earliest development (p. 14). It was in the double-stretch class; the fabric was first stretched on the core in its tread portion by suitable tension devices; and reciprocating jigger fingers were next employed in an endeavor to stretch, shape and apply the skirts to the sides of the core. These jigger fingers proved ineffective and the machine was junked. Moreover, the highest speed of this machine (Vol. I, p. 307, Q. 35) was only about 30 R. P. M. There was no possibility of throwing out the skirts by centrifugal force because of this low speed, and in any event the jigger fingers would have prevented such an effect. The patent also shows certain creasing or stitching rolls (Fig. 4) whereby the fabric was "tucked into a crease which exists near the lower end of the core and forced there with considerable pressure." These creasing rolls 91 (Vol. I, p. 484, Q. 74) were "sharp edged", and are clearly distinguished from State's rolls with rounded edges. This alone would have incapacitated them from any forming action on the sides of the core. Further, Fig. 4 shows that the effect of lifting the connected handle would be to carry them out of contact with the core, since due to the proportions the left-hand roll rises twice as fast as the right-hand roll. The jigger fingers were the side-forming devices and the only side-forming devices. Not only was there no centrifugal force but there was no hinging and folding action.

Moore patent. The Moore U. S. patent, Defendant's Exhibit L (Vol. 2, p. 273), presents mechanism which differs radically from that disclosed in State. It was designed to make *bicycle* tires and does not deal with flat fabric at all, but with a fabric which is *already woven into the desired shape* and conforming to the contour of the exterior of an expansible shell, as disclosed in the specification. No forming was necessary, although after it was placed on the expansible shell, the latter was expanded to stretch it. If it can be classified at all, it was in the single or circumferential stretch class. Generally speaking, the shaped fabric was cut into lengths and joined together at its ends so as to form a ring or endless band which was then placed on the shell and stretched by expanding the latter. Cement was then applied and the fabric allowed to dry and set. After this drying process, various other operations were gone through, one of which was to act on the wings which projected outwardly from the fabric and to turn them over on the body of the fabric and cause them to adhere to the fabric body. For this latter purpose, certain rolls were employed, and as they turned or *spun* on their axes, they might be termed "spinning rolls" in the latter sense. To indicate the totally different mode of operation, plaintiff's expert (Vol. I, p. 486, Q. 77) discusses at length the fifteen consecutive steps employed. This description is too long to detail here.

Moore certainly does not have the hinging or folding action of State, nor the use of centrifugal force to throw out the skirts wrinkle-free, nor any other steps of the State procedure. The only possible similarity is that the machine was equipped with a variety of rolls to be used for various purposes, as shown in Fig. 1. There is no forming or shaping to the sides of the core, for Moore's fabric is already shaped, and there is no re-arranging of the reticulations, for the cords were arranged in proper position by the previous weaving.

Jeffery patent. The Jeffery U. S. patent, Defendant's Exhibit M (Vol. 2, p. 285), illustrates a machine for making a bicycle tire and provided with a cylindrical drum which is etched on its surface with shallow grooves, the fabric, in the form of an endless ring, being pressed into these grooves by a sharp edged roller. This is so unlike the State mode of procedure (Vol. I, p. 489, Q. 79) as hardly to require discussion. It is not even referred to in defendant's brief. Whatever the speed of rotation of Jeffery's wheel, the fabric maintains its close relation to it. There can be no throwing out of the unattached skirts of the fabric since there are no such skirts. There is no stretching of the fabric radially against the side of the ring-core.

Bayne & Subers patent. The machine of the Bayne & Subers U. S. patent, Defendant's Exhibit N (Vol. 2, p. 291), not only does not deal with a flat woven fabric which it shapes to the core, but does not act on a fabric at all (Vol. I, p. 491, Q. 81). It handles threads or cords which it winds upon a core. For this purpose it utilizes three sets of grooved wheels, called "director wheels", over which the prepared threads are designed to run. This patent has now been dropped, but just why it was ever referred to is difficult to understand. The only point of interest is involved in the suggestion of defendant's expert that "there is no apparent reason why by simply rotating the machine in the *opposite* direction so that the wheels 19 would progress radially from without inwards (instead of in the reverse direction as when laying on the cords) the machine would not readily spin the fabric of a fabric tire smoothly down against the core". What this would imply is that by acting upon a fabric instead of upon the cords; by operating the machine in the opposite direction; by rotating the core fast enough to cause the fabric to fly out by centrifugal force; and by changing the contour of the grooved director wheels so

as to have rounded edges; an expert with his present knowledge could convert the Bayne & Subers machine into a State machine. The analogy is far fetched. Anticipations are not to be created by phantasmic speculations of this sort.

Metal spinning. The three U. S. Letters Patent, one to Dewey, and two to Seymour, Defendant's Exhibits Q, R and S, are referred to by defendant's expert as disclosing the art of metal spinning, but apparently are no longer relied upon, since no mention is made of them in defendant's brief. There is no analogy whatever therein to the shaping of flat fabric to a curved surface by stretching it and changing the shape of the thread reticulations. The word "spinning" is apparently what captivated the fancy of defendant's expert, and indeed the verbal similarity seemed to impress the Court of Appeals for the Sixth Circuit. However, both the mode of action and the results are totally different. Even defendant's expert admits different meanings in the use of the word "spinning", he first referring to its significance in the textile art in the forming of yarns. But that is a single isolated instance (Vol. I, p. 493, Q. 83). In addition to the spinning of yarn, and the spinning of metal, there is the spinning of tops, and the spinning of the State rolls ("they revolve at high speed", State specification, p. 5, line 95). In each there is the common employment of speed in the rotating of the spinning device; it is because of this speed that the word "spinning" in each instance is employed.

But in metal spinning, the metal is made to flow,—that is, it is displaced from one position to another. The metal cannot be changed greatly in shape unless it is repeatedly reheated, or unless it is maintained hot. There is nothing in metal spinning at all analogous to the action of the State forming or shaping roll.

The Dewey patent (Vol. 2, p. 319) is a fair example. It refers to the repeated annealing of the metal, and to

the necessity for preserving its malleability. He says that it is his purpose "to keep the metal annealed or in a softened condition during the greater part of if not the entire or complete formation of the article and *to decrease the number of molds as well as the number of pressings* usually required in forming or shaping the article". It is *because of this heat treatment* that he is enabled to change the shape of a sheet of metal and to decrease the number of molds, etc. In this particular instance he keeps the metal soft by the use of an electrical heater. Defendant's expert would imply that the sheet of metal stands out straight because of centrifugal force. This is obviously unfounded, since the metal though heated is still stiff, and not in the fluid condition which would be necessary to permit centrifugal force to act on it. By way of *reductio ad absurdum*, it may be pointed out that State does not heat his fabric to any such temperature as would be required to render metal semi-fluid, whether by electrical heater or otherwise.

The two Seymour patents show the prior sort of spinning to which the Dewey patent refers, in which only a limited amount of shaping of the metal can be produced without reheating. For instance (Vol. 2, p. 323), Exhibit R illustrates, in Fig. 6, a conical former whereby the metal is first shaped, and the specification says concerning it that it "may be used for giving shape to the article to be made in its first stages." That is to say, by several stages the metal is shaped to fit this former, and finally the shape is to be changed to that indicated by the former in Fig. 1, this last shape being given by the tool *t*.

The remaining Seymour patent (Vol. 2, p. 327), Defendant's Exhibit S, as shown in Fig. 1, starts with a previously formed cylindrical shell D with a hemispherical end, which end is clamped between the rotary mandrel B and the chuck C'. This shell is not shaped upon any core but is bent inwardly to the position indicated by the

dotted lines in Fig. 1. The specification refers to this operation at page 3, lines 29 to 40.

These instances show adequately that a number of different stages of action were required to get the metal article into final shape, just as the subsequent Dewey patent says was the case prior to his invention. This heat treatment and shaping of metal bears no resemblance to the forming of a flat fabric upon a ring-core, first by longitudinal stretching and then by radial stretching, as in the patent in suit. The only possible similarity is the verbal one involved in the term "spinning," which has many meanings. Even assuming there were some analogy, and it is not conceded for a moment, between the flowing of metal on a mandrel by repeated operations, and the shaping of a fabric on the sides of a core by a single operation, the new use and application of such a roll by State would be well supported under the doctrine promulgated by the Supreme Court in *Potts* v. *Creager,* subsequently noted.

Mathern Belgian Patent.

As this patent requires extended examination, it is perhaps better to make a general statement concerning it at the outset. It was not set up in the answer in the *Firestone* case, nor advanced before the lower Court. It was an unpublished patent and was not discovered until the case was before the Court of Appeals for the Sixth Circuit, when by stipulation and at the Court's request it was submitted for consideration. The Court did not hold it to be an anticipation, but used it simply as confirming the theory of aggregation, as will be pointed out later on.

It is purely a *paper* patent. *No machine was ever built under it.* It happened to have a roll which the Court

dubbed a "spinning-roll". It was not a spinning-roll like that of State, except in the sense that all rolls spin; State's specification (p. 5, line 95) says "they revolve at high speed". It was intended for a totally different purpose, namely, to eradicate pre-formed puckers and wrinkles *after* the fabric had been formed and cemented to the core. The patent shows the real forming and cementing means, and these other means are distinctly described as possessing the pre-forming and applying functions. There is no word in the specification describing or even applying any such functions for this roll. There is no reference to any forming effect by it or to centrifugal force. On the contrary, the roll is distinctly stated to be for the purpose of passing over the wrinkled fabric after it is formed and attached to the core.

The patent states that the fabric is first stretched circumferentially and pre-formed and is then cemented to the core. This circumferential stretching immediately places the Mathern arrangement in the *single-stretch class.*

The idea of subsequently removing wrinkles from already applied fabric (and this was a common plan in the earlier days) was impracticable. *Within a few months after his Belgian application, Mathern filed one in Germany, and in this latter case he abandoned the roll and substituted something quite different for it. And in the commercial machines which some time later he introduced into use, the roll did not appear, and he used in place thereof the new devices first appearing in his German patent.* In both this machine and in the German patent *he retained the stretching and applying devices* of the Belgian patent, which retention emphasizes the omission of the roll on which defendant now relies.

It must not be overlooked that the roll never appeared in metal until it was made for the purposes of litigation, and attached to defendant's model in evidence.

Nor is there any presumption of operativeness or validity flowing from the grant of the Belgian patent. Belgian applications were not subjected to exhaustive investigations as are American applications. Section 2 of the Belgian grant specifically states that it is delivered without previous examination, and without guaranty of the merit of the invention, or even of the exactness of the description. *And as a further indication of the worthlessness of the roll, the Belgian patent was allowed to lapse immediately.* Mathern did not even regard it as worth the twenty francs required as a first annuity to keep it alive. *Still another indication of its uncertain standing is in the fact that there is dispute as to the correctness of defendant's translation.* As will be subsequently shown, the authorities are strongly to the effect that in circumstances like these, an earlier patent, and especially when a foreign one, is without anticipating effect.

The principal complicating feature is that defendant produces a model alleged to embody the Belgian devices. It must be borne in mind that this exhibit is a model and not a commercial machine. The photographs appearing on pages 110 to 112 and elsewhere in defendant's brief were made from this exhibit model and are by no means representative of the machine actually disclosed by the Belgian patent. *It is a simple matter to take an early device and, in the light and knowledge of a later one, to change its construction and mode of operation so that it will act in the later way.* As plaintiff's expert Browne appropriately remarks (Vol. I, p. 461), the model, Defendant's Exhibit H, by emasculating the actual forming devices, and by making various other changes, can be operated to produce tires with the State mode of operation. But no anticipating effect can be presumed there-

from. Courts do not permit the revamping of an old structure in the light of modern art and then using it for purposes of anticipation:

Diamond Rubber Co. v. *Consolidated Rubber Tire Co.*, 220 U. S. 428:

> "Knowledge after the event is always easy, and problems once solved present no difficulties, indeed, may be represented as never having any, and expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by a merely skilful attention. But the law has other tests of the invention than subtle conjectures of what might have been seen and yet was not. It regards a change as evidence of novelty, the acceptance and utility of change as a further evidence, even as a demonstration."

McMichael v. *Ruth*, 128 Fed. 706:

> "The fact that an expert, with a patent before him, might be able to build up the structure covered thereby, by selecting and adapting appliances theretofore known, does not overcome the presumption of invention arising from the granting of the patent, where neither the same combination in its entirety nor the same mode of operation had previously been described or known."

National Co. v. *Belcher*, 71 Fed. 876:

> "Evidence by a trained mechanic that by following the suggestions of a prior patent, in respect to the duplication of the device therein described, he produced without difficulty a device substantially identical with that of the patent sued on, is not to be lightly accepted, since, being acquainted with the present art, he would naturally follow the suggestions thereof, or perhaps introduce suggestions of his own mind."

The translation. There is serious dispute as to the translation. On the face of the patent, the intended operation was the circumferential stretching of the fabric and other simultaneous pre-formation, and then its cementing to the core. This left *wrinkles* and it was Mathern's idea to eradicate them by the roll in question. The principal point of conflict is concerning certain kindred French words like *déplissement, déplissage, déplissé*, and the like: In the translation introduced by the defendant in the *Firestone* case, these words for the most part were translated as "unwrinkling", etc. (Vol. I, p. 460, Q. 47). This did not suit defendant here, and for obvious reasons. Defendant's Exhibit F prefers "pucker" to "wrinkle", and the latter word does not appear at all.

Plaintiff's translator is Professor Spiers of Columbia University, and in charge of French instruction at that college (Vol. I, p. 519). He says (Q. 5) that the first and correct translation of words like *"déplisser"* is to *unwrinkle*, etc., and he proceeds (Qs. 6 and 7) to give its derivation and the reasons for his statement. He testifies (Q. 8 *et seq.*) that "unpuckering" and the like are not proper if the French words be taken at all strictly. This is in direct opposition to the testimony of defendant's translator.

It may be noted also that Professor Spiers is of French descent and a member of the Spiers family, who are the authors of the well known French dictionaries, Spiers' Dictionary, Spier & Surenne's Dictionary, etc. On the other hand, defendant's translator (Vol. I, p. 209, x-Q. 11) is of Italian descent and (Vol. I, p. 208, Q. 3) received his education in French in the department of Columbia of which Professor Spiers is the head. There can be little question as to the weight of authority, and

particularly when considering the circumstance that the earlier *Firestone* translation freely used the words "wrinkle", etc.

Thus, from the outset the foundation of the entire fabric is shaky. But there is no room for uncertainty when questions of anticipation are being considered. As the Supreme Court said in the leading case of *Coffin* v. *Ogden, infra,* referring to defendant:

> "The burden of proof rests upon him, and every reasonable doubt should be resolved against him. * * * The law requires, not conjecture but certainty."

In a very recent case, *Permutit* v. *Paige,* 292 Fed. 439, a similar situation arose, and Judge Learned Hand said as follows:

> "The defendant's translation renders the last clause, 'at a height of one-third to one-half of a meter.' About this clause the learned doctors disagree, and it seems to me quite enough to say that the disagreement is honest without trying to solve it, which would be quite beyond my powers. To be a valid anticipation greater clarity is necessary, else there is no adequate warrant that the art was enriched. Read in connection with the earlier practice, this article did not to my mind clearly enough show the necessary departure. The law is not friendly to efforts like this to spell out a later invention in the light of what it has itself disclosed."

Other authorities to the same effect will be noted later on.

As to the word "pucker", plaintiff's expert (Vol. I, p. 510, x-Q. 133) says that he does not quarrel with its use as indicating the *original* condition of the skirts of the fabric after it has been circumferentially stretched.

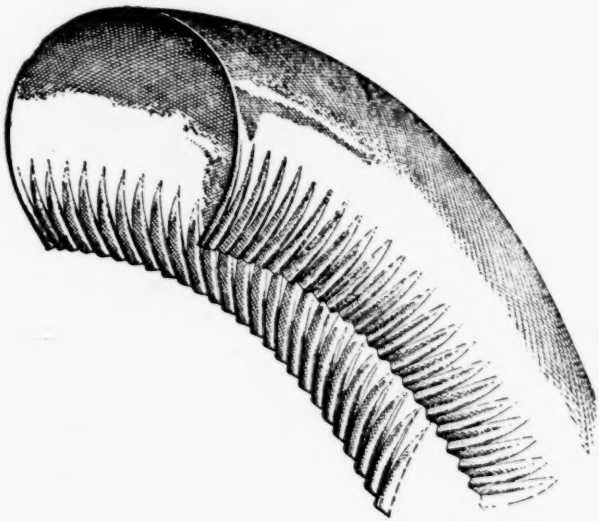
It is only when this puckered fabric is cemented to the core that the puckers are converted into wrinkles, and these Mathern hoped to eliminate by the use of the roll on which defendant now relies.

Mathern's general plan. A careful perusal of Mathern's specification leases little doubt as to his intention. His thought was to pre-form the fabric entirely, then cement it to the core, necessarily leaving wrinkles, which wrinkles he meant to eliminate with the tool of Fig. 6,—the roll set up as an anticipation of State's forming-roll. The idea of effacing wrinkles already formed on the core was poor and impracticable, but at the same time one in vogue in the early days. For instance, the Stevens patent, application filed April 12, 1913, Plaintiff's Exhibit No. 13, decribes the general scheme and condemns it:

> "Heretofore, machines have been constructed in which the tread-portion of the tire-fabric has been overstretched in order to cause the ply to conform roughly to the contour of the core and to reduce the amount of fullness or surplus in the fabric to be cared for or absorbed at the sides of the core, but in the use of these devices, in addition to the objectionable and weakening excessive stretching, wrinkles and other defects have occurred in those portions of the fabric applied to the sides of the core, dependence being placed upon a *subsequent* elimination of such wrinkles, either wholly or partially. The resulting detrimental effects of these defects thus occurring are not, however, completely overcome by the subsequent removal or smoothing out of the wrinkles or folds."

Mathern was on the same wrong track. Briefly summarized, he used spherical rollers 26 and tension mechanism to elongate the ply circumferentially, and gears 36 to pucker its edges. What he hoped to accomplish by

this pre-forming operation will perhaps be more clearly understood from the accompanying sketch than by mere



description. Assuming that he started with a strip 88 inches in length, his purpose was to elongate the tread portion by the spherical rollers 26 to 100 inches, and by means of his corrugating gears 36 to contract or convex the bead portion to 76 inches. It will be understood that these particular dimensions, in fact the entire example, are employed solely for purposes of illustration. Then, when the fabric was thus pre-formed, he applied or cemented it to the sides of the core by a pair of rollers 30, which reciprocated in much the same way as the earlier jigger fingers of Seiberling & Stevens. This necessarily produced wrinkles and stuck them to the core, and to eliminate the wrinkles or smooth them out he employed the tool of Fig 6, which he caused to pass over the entire fabric, starting it at "the top of the core" and causing it

"to descend progressively on the side of the core and all the way down to its base".

It is a simple matter now for those skilled in the art to point out that wrinkles cemented to the core could not be effaced in this way. But Mathern was not the only one to think it possible, as indicated by the quotation from the Stevens patent. That the plan was an entire failure is shown by the fact that he immediately abandoned the tool of Fig. 6, and in his German application a few months later he substituted something else for it, although he retained the stretching rolls 26, the corrugating gears 36, and the reciprocating cementing rollers 30. And when he put out his commercial machine four or five years later, he similarly left out the tool of Fig. 6, although he retained in it the stretching rolls 26 and the cementing rolls 30. The abandonment is further corroborated by his allowing the Belgian patent to lapse through his failure to pay the first annuity of twenty francs. And yet this tool of Fig. 6 is now set up by defendant as an anticipation of State's roll.

Plaintiff's expert describes the construction and mode of operation of the Mathern Belgian patent (Vol. I, p. 461, Q. 49).

The stretching rolls. The fabric is wound on a drum 18 and its tension is regulated by suitable braking mechanism to control the stretch. The middle portion of the fabric passes around the rolls 26, and these produce "*a slight lengthening of the middle of the fabric*". This accomplishes the original circumferential stretching. It will be understood that the quotations here and further on are from defendant's translation, irrespective of its accuracy.

The gears 36. Alongside the rolls 26 are the conical gears 36, one at each side of the fabric, whose "sole purpose", the specification says, is "to produce *a slight*

uniform puckering of the fabric strips at their edges, ensuring in advance *a uniform contraction of the fabric* at all points". This attempted result is graphically shown in our previous cut. The combined effect of the rolls 26 and gears 36 in pre-forming the fabric, by stretching it at its middle and gathering it at its sides, is also referred to in claims 2 and 8 of the Mathern patent. Claim 2 specifies "a set of gears and of spherical rollers for producing *a uniform lengthening and convexing* of the fabric, thereby facilitating the sticking of it to the core". And claim 8 refers to winding the fabric strips on the core "after a *preliminary lengthening and convexing*".

The specification says, after referring to the preforming:

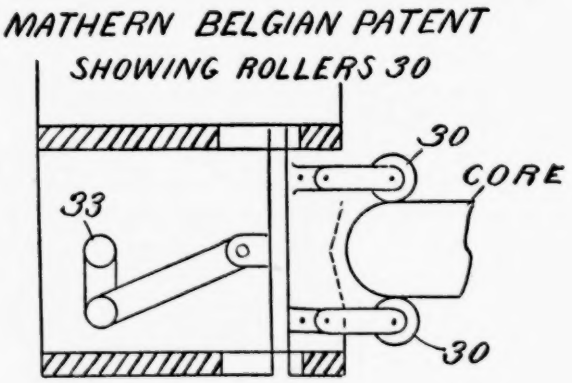
> "Next the fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement."

As the strip is under tension, the effect would be to shape it still further to the periphery of the core and to cement its tread zone thereon. While the fabric is thus being wound upon the core the reciprocating rolls 30 are at work for the purpose of applying and cementing it to the *sides* of the core.

The Rolls 30. The action of these rolls is referred to at four places in the specification:

> "As the fabric is pulled along and unwound from the drum 18 it encounters the rollers 30 on the casing 28. This casing 28 encloses a vertical bent shaft 33, which actuates a slide 32, that is guided in the walls of the casing 28. This slide 32 carries two rods 31 at two joints. Each of these rods carries at its ex-

tremity, a roller 30, which advances and retracts on the core, so as *to stick to its straight or convex sides the fabric* which has just been placed there."



The function of the rolls is clearly to "stick" the fabric against the sides of the core, whatever its shape may be.

Again:

"* * * (*b*) of the principle of rollers 30 advancing and retracting in a radial direction while bearing on the core for *cementing the fabric on its sides.*"

And in claim 3:

"* * * a device consisting of one or more sets of rollers carried by a carriage which receives, through a bent shaft, a reciprocating movement perpendicular to the axis of the core in order *to stick the fabric on the sides of the core.*"

And in claim 8,

"* * * (*b*) *sticking the fabric on the sides of the core.*"

Thus, the middle zone of the fabric is caused to adhere to the periphery of the core as the fabric is wound on it, and the reciprocating rolls 30 cause its skirts to stick to the sides of the core. Defendant reads the foregoing passages as meaning the "*central* side portions" of the core (p. 30 of its brief), but as will be apparent, no such qualification appears in the patent itself.

The specification says nothing about the speed of the core during the application of the fabric to its periphery and sides, but it must be slow to permit the reciprocating rolls 30 to act effectively in applying and cementing the fabric thereon. He does not even illustrate or describe means for rotating the crank shaft which reciprocates the rolls 30. This shaft might be rotated by hand, in which event the winding of the fabric would be extremely slow in order to enable the reciprocating rolls to perform their office.

The result of the actions up to this point is to apply the fabric to the core with wrinkles, etc., in it, and these wrinkles or puckers have been intentionally made at its sides by the conical gears 36. And wrinkles exist also in other portions of the fabric, inevitably so if the preforming rolls 26 are of the shape shown in the drawings. Mathern then proceeds in his attempt to remove these wrinkles by the employment of the tool "shown in Fig. 6".

The Tool of Fig. 6. This tool is *loosely suspended upon the pin 35* projecting from the vertically-fed tool carrier 17. Its sole described function is to unwrinkle the fabric or to remove the wrinkles or puckers therefrom. This action is referred to in four places in defendant's translation:

> "On the support 17, which constitutes a tool carrier, there is mounted a tool like that shown in Fig. 6, which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 is adjusted so that the roller comes *to the level of the top of the core.*

> Then the machine is set in operation and the roller is caused *to descend progressively on the sides of the core and all the way down to its base.* Thus there is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34."

Of course, two of these rollers may be employed simultaneously, but their action is *over the entire surface* of the fabric from * * * "the top of the core" "down to its base". It was Mathern's intent by this comprehensive action to remove all puckers and wrinkles, wherever located in the fabric. Again:

> "* * * (c) of the principle of the roller descending progressively on the core during rapid rotation and producing a progressive removal from the fabric of the puckers by eliminating the puckers from the point of their origin, this being performed in a single descending movement."

This means that each pucker or wrinkle is acted upon at the point where it begins by the roller which operates throughout the fabric as far as the pucker extends. Claim 4 of the Mathern patent specifies:

> "a tool carrier having rollers and arranged to move downward automatically and progressively, dependent on the rotation of the core, in order to progressively *efface the puckers* of the successive strips of fabric."

Finally, claim 8 specifies:

> "(c) *eliminating the puckers formed.*"

It may be noted again that the *sole office* of the rollers of Fig. 6 mentioned in the Mathern specification *is the removal or elimination of wrinkles or puckers* which are present in the fabric after it has been applied and cemented to the core. *There is no reference whatever to the*

tool of Fig. 6 as possessing any applying or cementing function. On the contrary, such function is ascribed, and ascribed only, to the previously employed rolls 30. Even without other considerations, this in itself is entirely adequate to differentiate the tool of Fig. 6 from the State roll which *simultaneously shapes the fabric and applies it to the core.*

Mathern refers to a fast rotation of the core during the action of the tool of Fig. 6, but this arises from the fact that the attempted removal of the puckers would be intolerably slow if the core were rotated at the same slow speed as is employed when the fabric is drawn on to the core and cemented thereon by the rolls 30.

Different State mode of operation. The described action of the Mathern devices is strikingly unlike that disclosed in the patent in suit. State does not pre-form his fabric and he has nothing at all resembling the spherical rollers 26 or the gears 36 of Mathern. State does not cement the skirts of the fabric to the sides of the core as the fabric is drawn on to it, and he has nothing like Mathern's reciprocating side-cementing rolls 30. Mathern *intends to put puckers into* the sides of his fabric by his conical gears 36 and it was his subsequent endeavor to remove or efface the wrinkles by the tool of Fig. 6. After State has stretched the fabric on the core and when his spinning-rolls are brought into action, the skirts are free and loose and baggy in order that the spinning-rolls may act upon smooth surfaces of the fabric, and the core is rotated at sufficiently high speed to spread the skirts out and away from the core by centrifugal force. Then, the carriage for the spinning-rolls is fed radially inward and the rolls act upon the progressively formed hinges of the skirts, so that the skirts are shaped, formed and cemented to the core as the result, exclusively of the action of the spinning-rolls during the high-

speed rotation of the core. *How absurd for Mathern to supply conical gears to put puckers into the fabric and thus contract it, if immediately thereafter, as the defense asserts, he is going to use centrifugal force to expand the fabric and throw it away from the core!* Why does defendant adopt a theory of operation which takes all the utility out of the puckers when Mathern takes such pains to assign utility to them?

Operation of model (Vol. I, p. 460, Q. 48). Of course, in the light of the present knowledge of tire-making on the State machines, it is now possible to take the machine of the Belgian patent, remove the puckering gears 36, or so use them as to be ineffective to perform the office which the patent sets forth; remove the side-applying and cementing reciprocating rolls 30, or so employ them as to perform no useful office; stretch the fabric on the core so that it is only applied to the tread zone; and run the core during the spinning down of the skirts at such high speed as to maintain them in an unwrinkled condition where the forming-rolls act upon them. Could the machine be so used, then a workman sufficiently skilled to handle the rolls shown in Fig. 6 could produce a useful tire carcass upon the Mathern machine. And that is exactly what defendant has done, and it is exactly the practice which has been proscribed by the Courts in the cases before cited.

The fatal thing,—the self-destructive feature,—is the suppression or emasculation of the fluting gears 36 and the cementing rollers 30. Defendant's expert is forced to allege with regard to the former that they do not have "any important or essential function", and as to the latter that the machine will operate "satisfactorily with the action of the rollers 30 omitted". He makes these statements gravely, although confronted with the very precise description in the Belgian specification and even in the claims of their functions and importance; and although

in the immediately succeeding German patent Mathern *retains* the gears 36 and rollers 30 which defendant's expert says are useless, and *discards* the tool of Fig. 6 to which defendant's expert ascribes all the merit.

Defendant's specific contentions. Defendant's treatment of the Mathern patent involves a number of untenable and unjustified assumptions and contentions, some of which will be next examined.

There is no authority (Vol. I, p. 469, Q. 51) for the assumption of defendant's expert that the low speed of the Mathern machine may be 4, 6, or 8 R. P. M. and the corresponding high speeds 81, 121½ and 162 R. P. M. The only information Mathern gives is that there are two speeds and that the high speed is twenty and one-quarter times that of the low speed. *If the low speed were 1 R. P. M. then the high speed would be 20¼ R. P. M., and Mathern's low speed cannot be much greater than 1 R. P. M. to give the rolls 30 time to cement the skirts to the sides of the core.*

There is no authority (Vol. I, p. 469, Q. 52) for the statement of defendant's expert that Mathern's patent discloses spinning or stitching rolls. State's rolls act upon the centrifugally thrown out skirts and form, shape and cement them to the sides of the core, and have no office at all of removing wrinkles or puckers from an already applied fabric. Whereas, the Mathern specification nowhere refers to any shaping, forming, or cementing action of the roll of Fig. 6, the only office ascribed to it being the removal of wrinkles or puckers.

There is no authority (Vol. I, p. 469, Q. 53) for the assumption of defendant's expert that the patent discloses automatic means for feeding the rolls inwardly. While it has the mechanically fed tool carrier 17 with a laterally projecting pin 35, *the tool of Fig. 6 is merely suspended on this pin.* He admits himself "that they merely hook over" the pins and *"are guided and pressed to the work*

by the hand of the workman", and "that if they encounter an obstacle while being positively fed downward, they simply *lift* from their pivots". The workman performs the act of feeding the tool downward as well as of pressing its against the core, and the only function of the slide 17 and pin 35 is to prevent him from feeding it too fast. There is no "automatic means for feeding" the rolls in this, or in fact any feeding means at all.

There is no authority (Vol. I, p. 471, Q. 54) for the statement of defendant's expert that the slide which carries the rolls 30 is moved only "a short distance" back and forth. The crank shaft 33 is described as the reciprocating means and the drawings indicate a sufficient throw to give them a long reciprocation. The drawings are defective in that the guide slot is too short, but in the model, Defendant's Exhibit H, the slot limitation has been removed and the crank shaft is rotated around and around. If defendant's correction be justified, there is ample movement to reciprocate the rolls 30 over the entire sides of the core, and they are competent to perform the office ascribed to them in the specification.

There is no authority (Vol. I, p. 471, Q. 55) for the statement of defendant's expert that it is impossible for the tools of Fig. 6 "to act on the tread portion as they would simply be lifted off from their supports". On the contrary, the specification states that at the outset the tool of Fig. 6 "comes to the level of the top of the core" and that it descends progressively "all the way down to its base".

There is no authority (Vol. I, p. 472, Q. 56) for the mode of action attributed to the tool of Fig. 6 by defendant's expert, in his endeavor to obviate the difficulty last noted, that the operator brings the roll of Fig 6 "*about* to the level of the top of the core" and then starts the machine and by "the time he has assumed this working position" the rolls will have reached the proper level to begin action. The statement in the specification that the

roll starts at "the level of the top of the core" is of course a death blow to his theory that the roll operates only to apply the fabric from the median line, and therefore he is forced to suppose that there is an idle interval and that time must be wasted. The description is specific, not only that the roller starts at the top of the core, but also that it "is caused to descend progressively on the side of the core and all the way down to its base". One act is mentioned as immediately following the other and there is no suggestion of any idle interval. Referring further to this theory, there is no reference in the specification to the roll as spinning the fabric "smoothly into shape and simultaneously applying it to the cemented surface of the core." There is no mention whatever of any spinning function by the roll; no suggestion that it effects the shaping of the fabric; and no suggestion that it applies any portion of the fabric to the core. The only office attributed to the tool is the removal or effacement of puckers or wrinkles already in the fabric.

There is no authority (Vol. I, p. 474, Q. 57) for the statement of defendant's expert that the Belgian patent "has automatic feeding means making it in a real sense an automatic machine". As before pointed out, the tool carriage 17 does not constitute an automatic feed for the roll, but is merely a restraining guide to keep it from being fed too fast.

There is no authority (Vol. I, p. 476, Q. 61) for the statement of defendant's expert that the Goodyear machine is like that of the Belgian patent in that in both, after the original stretching, the tread portion is rolled into contact with the core. A tread roller is shown and described in the State patent and may or may not be used. Mathern's rolls 30 do not act upon the tread portion, but are described as acting upon the *sides* of the core.

There is no authority (Vol. I, p. 476, Q. 62) for the assumption of defendant's expert that the only things to be effaced are the "puckers" formed by the corrugating

gears 36, and that there are no wrinkles to be removed after the application of the fabric to the core. This is entirely inconsistent with the reference to the original stretching or lengthening, "which lengthening greatly facilities the removal of the puckers". *If defendant's translation be correct*, when Mathern stretches the fabric to facilitate "the removal of the puckers", he is *simultaneously forming the puckers* in the edges of the fabric by the bevel gears 36! Of course, the stretching of the fabric has nothing to do with the subsequent removal of these particular puckers. Therefore, the "puckers" (obviously *wrinkles*), whose removal is facilitated by the stretching, must be those formed in the body of the fabric and which Mathern says are subsequently removed by starting the tool of Fig. 6 at "the top of the core". There is thus developed a palpable absurdity and it arises from incorrect translation. If the word "*déplissage*" at this point be translated *removal of the wrinkles* instead of "removal of the puckers", the sense is clear. Professor Spiers testified to the effect that the preferable translation is "unwrinkling" or the like, and in the *Firestone* case the passage was translated as "greatly facilitating the unwrinkling".

There is no authority (Vol. I, p. 478, Q. 63) for the assumption of defendant's expert that the tool of Fig. 6 is to be used in conjunction with a high speed core, in practically the same manner as State's rolls and core are employed. This is also apparent when the function of the corrugating gears 36 is considered, the specification describing their action as for the purpose of contracting or convexing the fabric. Defendant's position is absolutely untenable. The rotation of the Mathern core at high speed, if the fabric were not already cemented thereto, would throw the skirts out by centrifugal force away from the sides of the core in such way as to negative the convexing effect of the gears 36. *It would be wholly senseless to contract or convex the fabric to the approxi-*

mate shape of the core, and then immediately after destroy the shape which such pains had been taken to secure.

Subsequent history. As related (Vol. I, p. 479, Q. 64), the Belgian patent was abandoned and allowed to lapse because of the failure to pay the first annuity of twenty francs. This is confirmed in the official publication "Moniteur Belge" of August 9, 1908, in evidence as Plaintiff's Exhibit No. 14.

Mathern German patent. This German patent would be without anticipatory effect, even if there were similarity of mechanism, for the reason that it was not published until January, 1909, many months after State's development and the installation of his first commercial machine. The application was filed a few months after the Belgian application, and the patent is of interest only (Vol. I, p. 480, Qs. 65, 66) in that Mathern retained the corrugating gears 36 and the reciprocating rolls 30 of the Belgian patent, which defendant's expert says are practically useless, and discarded the tool of Fig. 6, which defendant's expert regards as of the first importance.

In place of the tool of Fig. 6, the German patent shows an oscillating sector or cradle 29, carrying a series of stepped rolls 38, which rolls move only in a concentric path and have no radial component whatever. Again, the core is described in the Belgian patent as making a number of rotations while the tool of Fig. 6 is acting; in the German patent the core makes but a single rotation during the operation of the substituted rolls 38.

Mathern commercial machine. The only evidence as to Mathern's commercial machine is given by defendant's witness, Duncan, who testifies (Vol. I, p. 196, Q. 15) that the Hood Company installed one in the latter

part of 1911, or more than three years after the first State commercial machine. He admits (Vol. I, p. 203, x-Q. 63) that it was not provided with the tool of Fig. 6 of the Belgian patent, but had (x-Q. 64) the means shown in the German patent at 29 in Fig. 1 of the drawings; and (x-Q. 65) that it had the pair of reciprocating rollers 30 shown both in the Belgian and German patents. Later on the Hood Company altered the construction in various particulars unessential to this case.

This particular machine was used as the foundation of the Mathern Belgian model introduced in evidence herein as Defendant's Exhibit H. In some respects it had the general structure shown in the Belgian patent, but numerous alterations had to be made. The principal change was the addition of the tool of Fig. 6,—*the first time that particular feature ever appeared in metal*, and even then not as disclosed in the Belgian patent but in a new and revised edition.

Court of Appeals for the Sixth Circuit on Mathern.

The Court of Appeals for the Sixth Circuit could not find anticipation in the Belgian patent but endeavored to use it in support of its aggregation theory. It says:

> "* * * Still further,—it is conceded that the Belgian patent is a complete anticipation of State as to the matter of employing a radially-moving spinning roll in this type of tire-making machine for shaping the side of the tire,—*unless plaintiff is right in his contention that in the Belgian patent the fabric was first partially attached to the side by a device resembling Seiberling and Stevens' jigger fingers, that this operation left wrinkles and puckers, and that the spinning roll was used to remove these wrinkles and perfect the attachment.* We do not see that this alleged distinction is very important. No matter if the fabric has been already partially attached,—as much as is consistent with

any reasonable theory of operation,—the tool of the Belgian patent is a spinning roll, and performs a spinning operation; and, if we are right in what we subsequently say regarding the 'centrifugal force' theory, the Belgian tool in its radial progress was bound to stretch and reshape the fabric in substantially the same way that is done by State. Putting all these things together, State can not be considered as the inventor of the method; and hence there is no reason to hesitate at the result reached *because of aggregation.*"

As to which the following comments seem to be in order:

1. The first sentence sufficiently expresses the Court's unwillingness to accept the Mathern patent as full anticipation.

2. It has never been clearly understood what was meant by the expression, "it is conceded that the Belgian patent is a complete anticipation", etc. Plaintiff never conceded it in word or deed. If the language means that the Mathern *model* can be operated along the State mode of action and with State's results,—plaintiff is willing to concede this. But no such mode of action is disclosed in the Mathern patent, and the Courts have positively condemned such reproductions in the light of subsequent art. Moreover, in the earlier case the Mathern patent was submitted on affidavits. Here it is discussed in depositions.

3. "We do not see that this alleged distinction is very important. * * * the tool of the Belgian patent is a spinning roll". Considered merely from the dictionary standpoint, the statement is probably correct.* The roll does spin in the sense of rotating

* Standard Dictionary: "To whirl or turn round rapidly, as a top; also to rotate rapidly on an axis, as a pulley." Compare the language "they revolve at high speed" in State's specification, page 5, line 95.

or whirling, but there is no *forming* action like that of the State roll. It is submitted that something more than mere words should control and that the real test is *function*, and particularly when the part is a cooperating element in a specified combination. Moreover, as later pointed out, the disclaimer clears up all questions of verbal anticipation, as it ascribes the proper functions to the roll and cooperating core.

4. "if we are right in what we subsequently say regarding the 'centrifugal force' theory". This has already been discussed. What the Court refers to is its later statement,—"To make centrifugal force an effective basis of validity in the State patent would be to give a monopoly of the spinning process or of rapid core rotation; and each was old." *Neither was old.* There was no word or evidence in the earlier record to support such a finding, and there is positive evidence in the present record that the high speed referred to and its resultant centrifugal force were new. The only prior speeds definitely given are 30 R. P. M. for the Seiberling & Stevens machine (Vol. I, p. 307, Qs. 34, 35) and (Vol. I, p. 168, Q. 13) "from 50 to 60 revolutions per minute" for hand spinning. It is now established that the *minimum* speed at which centrifugal force becomes effective is somewhere between 80 R. P. M. and 120 R. P. M. If the Court of Appeals for the Sixth Circuit had had the present record, it would not have made the quoted statement.

5. The last sentence affirms the Court's general technical position that State's claims were void because of aggregation, and not because of anticipation.

Court of Appeals for the Third Circuit on Mathern.

In the present case, the Court of Appeals for the Third Circuit disposed of the Belgian patent to Mathern, as follows:

> "As we have said before, State's was the first successful machine in this country to make a double stretched automobile tire by machinery. It is contended, however, that what he did was anticipated by the Belgian Patent No. 194,731, granted September 20, 1906, to Alphonse Matherne, for a machine and process for mechanically manufacturing casings for pneumatic tires. Without entering into minute details, it suffices to say that by certain mechanism Matherne proposed to unwind the fabric which is advanced to the core, and to stick or plaster it to the tread circumference, or, as the patent states,
>
> > 'As the fabric is pulled along and unwound from the drum 18 it encounters the rollers 30 on the casing 28 * * * each of these rods carries at its extremity a roller 30 which advances and retracts on the core, so as to stick to its straight or convex sides the fabric which has been placed there.'
>
> "In addition to thus plastering the tread portion and thereby lengthening the fabric along the line of the median circumference of the core, the outer or free edges of the fabric were lessened in length by a process of crimping, which is described in the patent as follows:
>
> > 'The fabric on leaving the drum passes between two rolls that are spherical or oval in form and arranged in such a manner as to produce a slight lengthening of the middle of the fabric, which lengthening greatly facilitates the removal of the puckers. On the same support there is mounted at each side, two conical gears 36, the sole purpose of which is to produce a slight, uniform puckering

of the fabric strips at their edges, ensuring in advance a uniform contraction of the fabric at all points.'

"Now it will be observed that at this stage, while there is lengthening of the median line of the fabric by circumferentially stretching, there is no contraction of the outer edges by radial stretching. It is true, the edge of the fabric has been crimped or puckered, but this puckering, while it has shortened the line by forming puckers, has not changed the square of the fabric into a radial diamond-shaped interstice, as is the case in State's machine. Moreover, this puckered edge or skirt was not left free as in State, but was plastered down by Matherne to the side of the core, in that regard the patent saying:

'The fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement.'

"To smooth out the designedly formed puckers or wrinkles on the cemented edge of the fabric, Matherne provides a forked tool which has a rounded roller set at an angle on a sliding tool carrier. The operation is thus described:

'On the support 17, which constitutes a tool carrier, there is mounted a tool like that shown in Fig. 6, which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 is adjusted so that the roller comes to the level of the top of the core. Then the machine is set in operation and the roller is caused to descend progressively on the side of the core and all the way down to its base. Thus there is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34. Both sides may be readily worked at the same time, by mounting two tools like that shown in Fig. 6, on the sliding tool carrier 17. * * * This last device (the tool of Fig. 6) has a great advantage in being manually controlled, whereby it has the capacity of easily passing over the beads.'

"We cannot accede to the contention that Matherne's disclosure had the effect of destroying State's practically operated and highly successful machine. There is no evidence that the machine in the form disclosed by Matherne had any effect on the art. In point of fact, he suffered the patent to lapse in default of the first payment required after its issue, and when he subsequently obtained a German patent he abandoned his rollers and adopted another form of mechanism. But wholly apart from these considerations, we feel that Matherne did not touch upon or solve the problem overcome by State. In the first place, he deliberately formed puckers and then sought to eliminate them, a procedure wholly different from State, who never formed puckers, and indeed prevented their formation by radial stretch and radial diamond pointed interstices. Matherne plastered his puckers to the core without stretch, and thereafter sought to roll out the puckers. State, on the other hand, left the skirts of his fabric free, and stretched those fabric edges into radial diamond-shaped interstices, by the use of high-speed core rotation. Indeed, the whole process of Matherne, so far as the side and inside or bead zone of the fabric was concerned, was simply the use of a hand roller to iron out the puckers he had deliberately formed and plastered on the core. Had the art stopped with Matherne's proposed machine, the auto tire art would not have had the impetus brought about by State's disclosure."

It is evident from the above quotation that the Court of Appeals for the Third Circuit saw clearly that the Mathern patent did not disclose the real invention of State involving the use of a high speed core functioning to throw out and extend the skirts of the fabric in an unwrinkled and puckerless condition, combined with spinning rolls forced to travel at regulated degrees in fixed radial guides and under the pre-regulated pressure of springs or weights, for applying the outflung free, unwrinkled and unpuckered skirts of the fabric to the

bead zone of the core, so as to result in a radial stretch of the meshes of the fabric at that point, as in both plaintiff's and defendant's machines.

Authorities on Anticipation.

In order to defeat a patent in suit, the alleged anticipation must be definite and positive, and nothing must be left to conjecture or uncertainty. The burden of proof in these respects is upon defendant, and every reasonable doubt must be resolved against it. The Mathern Belgian patent does not measure up to the requirements, and the other patents set up by defendant are of course even more remote. Authorities are so numerous that reference is made only to a few of the opinions of this Court:

Coffin v. *Ogden*, 18 Wall. 120:

> "The invention or discovery relied upon as a defense, must have been complete, and capable of producing the result sought to be accomplished; and this must be shown by the defendant. The burden of proof rests upon him, and every reasonable doubt should be resolved against him. If the thing were embryotic or inchoate; if it rested in speculation or experiment; if the process pursued for its development had failed to reach the point of consummation, it cannot avail to defeat a patent founded upon a discovery or invention which was completed; while in the other case there was only progress, however near that progress may have approximated to the end in view. The law requires, not conjecture but certainty. If the question relate to a machine, as thus exhibited, the conception must have been clothed in substantial forms which demonstrate at once its practical efficacy and utility. *Reed* v. *Cutter*, 1 Story, 590."

Seymour v. *Osborne*, 11 Wall. 516:

"Mere vague and general representations will not support such a defense, as the knowledge supposed to be derived from the publication must be sufficient to enable those skilled in the art or science to understand the nature and operation of the invention, and to carry it into practical use."

Topliff v. *Topliff*, 145 U. S. 156:

"It is not sufficient to constitute an anticipation that the device relied upon might be made to accomplish the function performed by the patent in question, if it were not designed by its maker, nor adapted, nor actually used, for the performance of such functions."

Carnegie Steel Co. v. *Cambria Iron Co.*, 185 U. S. 421:

"This defense presents the common instance of a patent which attracted no attention, and was commercially a failure, being set up as an anticipation of a subsequent patent which has proved a success, because there appears to be in the mechanism described a possibility of its having been, with some alterations, adaptable to the process thereafter discovered."

Cohn v. *U. S. Corset Company*, 93 U. S. 366:

"It must be admitted that, unless the earlier printed and published description does exhibit the later patented invention in such a full and intelligible manner as to enable persons skilled in the art to which the invention is related to comprehend it without assistance from the patent, or to make it, or repeat the process claimed, it is insufficient to invalidate the patent."

Bates v. *Coe*, 98 U. S. 31:

"Certain extracts from a printed publication were also introduced in evidence by the respondents for the same purpose, in respect to which it is only necessary to state that, in the judgment of the court, they

fall far short of what is required in such a controversy to constitute satisfactory proof that the invention had been described in a printed publication prior to the invention of the complainant."

Clough v. *Gilbert & Barker*, 106 U. S. 166:

"The structure was not designed for the same purpose as Clough's; no person looking at it or using it would understand that it was to be used in the way Clough's is used, and it is not shown to have been really used and operated in that way."

This Court has gone further and indicated that even when the *actual thing* was in existence *accidentally* or *incidentally*, it is no anticipation.

The leading case is *Tilghman* v. *Proctor*, 102 U. S. 707. Mr. Justice Bradley says:

"If the acids were accidentally and unwittingly produced, whilst the operators were in pursuit of other and different results, without exciting attention and without its even being known what was done or how it had been done, it would be absurd to say that this was an anticipation of Tilghman's discovery."

This doctrine has been reaffirmed in the recent case of *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, wherein it is stated:

"In the first place we find no evidence that any pitch of the wire, used before Eibel, had brought about such a result as that sought by him, and in the second place if it had done so under unusual conditions, accidental results, not intended and not appreciated, do not constitute anticipation. *Tilghman* v. *Proctor*, 102 U. S. 707, 711; *Pittsburgh Reduction Company* v. *Cowles Electric Co.*, 55 Fed. Rep. 301, 307; *Andrews* v. *Carman*, 13 Blatchford, 307, 323."

Attention is again particularly directed to the cases previously quoted from to the effect that an early machine reconstructed and revised in the light of the later art cannot serve as an anticipation.

Doctrine of Potts vs. Creager. With especial reference to metal spinning, wherein "spinning" rolls are employed, the Courts have held that the adaptation of a device from another art constitutes invention, unless that other art is a closely analogous one. Of course, in metal spinning the mode of operation was totally different. There was nothing to parallel State's use of centrifugal force to hold the fabric out smooth and wrinkle-free away from the core. There was no hinging and folding effect, or any of the various other important steps which characterized State's action. The metal was simply pushed down over the mandrel in successive steps and after successive re-heatings. The only possible similarity is the verbal one involved in the term "spinning".

The leading case is *Potts* v. *Creager*, 155 U. S. 597:

> "Indeed, it often requires as acute a perception of the relations between cause and effect, and as much of the peculiar intuitive genius which is a characteristic of great inventors, to grasp the idea that a device used in one art may be made available in another, as would be necessary to create the device *de novo* * * * The apparent simplicity of a new device often leads an inexperienced person to think that it would have occurred to any one familiar with the subject; but the decisive answer is that with dozens and perhaps hundreds of others laboring in the same field, it had never occurred to any one before. The practiced eye of an ordinary mechanic may be safely trusted to see what ought to be apparent to every one."

This doctrine has been affirmed by this Court in other cases, such as *Hobbs* vs. *Beach*, 180 U. S. 390, and *DuBois* v. *Kirk*, 158 U. S. 58.

The Mathern abandonment. It has been frequently found that a patent for a commercial failure or an unsuccessful experiment does not anticipate. This doctrine has peculiar significance in connection with the proofs that Mathern immediately abandoned the tool of Fig. 6 on which defendant here relies. As this Court said in *Deering* v. *Winona*, 155 U. S. 302:

> "Doubtless he did use a rigid extension of some sort; but if he ever used a pivoted device at all—of which we have considerable doubt—his efforts in that direction must be relegated to the class of unsuccessful and abandoned experiments, which, as we have repeatedly held, do not affect the validity of a subsequent patent."

See also:

Coffin v. *Ogden*, 18 Wall. 120;
Carnegie v. *Cambria*, 185 U. S. 421;
Whitely v. *Swayne*, 7 Wall. 685;
Smith v. *Goodyear Vul. Co.*, 93 U. S. 486;
Brown v. *Guild*, 90 U. S. 23 Wall. 181;
Coupe v. *Royer*, 155 U. S. 565;
Gaylor v. *Wilder*, 10 Howard, 477;
Cimiotti v. *American Co.*, 198 U. S. 400.

The lapse of the Belgian patent. Similarly, the lapse of foreign patents because of failure to pay subsequent annuities, as in the case of the Mathern patent, has been held an evidence of their worthlessness:

Carnegie Steel Co. v. *Cambria Iron Co.*, 185 U. S. 403;
Streator Cathedral Glass Co. et al. v. *Wire Glass Co. et al.*, 97 Fed. 950; 38 C. C. A. 573;
Cimiotti Unhairing Co. v. *American Fur Co.*, C. C. N. J., 120 Fed. 672.

The differences in translation and expert interpretation. As already pointed out, defendant's translation of the Belgian specification differs in important particulars from that submitted in the earlier litigation, and has also been adversely criticized by Professor Spiers. In addition, the experts submit widely divergent views as to the Mathern disclosures,—a fact in part due to the uncertainty of translation. This creates a condition far removed from the certainty and positiveness required for anticipation. As the Court of Appeals for the Third Circuit said in *Goss* v. *Scott,* 110 Fed. 402:

> "We may add, however, that in them only general language was used, and an intent announced by the patentee to occupy a general field. But such paper intent never materialized in plans or specifications. On the important element of form heading no light is thrown. Within the scope of the general language used, opposing experts have constructed widely different types of presses."

As stated in *Cimiotti* v. *Comstock,* 115 Fed. 524:

> "A document so obscure in its terminology that two conflicting theories may be deduced therefrom and supported by equally plausible arguments is too indefinite to be utilized as an anticipation."

Or, as said in *Hillard* v. *Fisher,* 159 Fed. 439:

> "Where they [the statements] are so vague, involved, intricate and contradictory that experts disagree radically as to their meaning and, following the instructions given, construct devices differing in fundamental features, it is safe to reject such a document as an anticipation."

See also:

Underwood vs. *Elliott-Fisher,* 165 Fed. 930;
Stead Lens Co. v. *Kryptok Co.,* 214 Fed. 376.

Invention May Reside in the Combination of Old Elements, and Particularly When They Co-operate With a New Mode of Action.

The general doctrine as to the combination of old elements has been enunciated in many cases. The two leading ones are opinions of this Court, to wit: *Loom Co.* v. *Higgins*, 105 U. S. 591, and *The Barbed Wire Patent*, 143 U. S. 283. A consideration of both is unnecessary, for the reason that in the latter this Court refers to and approves the former:

> "There are many instances in the reported decisions of this Court where a monopoly has been sustained, in favor of the last of a series of inventors, all of whom were groping to attain a certain result, which only the last one of the number seemed able to grasp. Conspicuous among these is the case of *Webster Loom Company* vs. *Higgins*, 105 U. S. 580, 591, where an improvement in looms for weaving pile fabrics *consisting of such a new combination of known devices* as to give to a loom the capacity of weaving fifty yards of carpet a day, when before it could only weave forty, was held to be patentable. It was said by the Court, in answer to the argument that the combination was a mere aggregation of old and well known devices, that 'this argument would be sound if the combination claimed by Webster was an obvious one for attaining the advantages proposed —one which would occur to any mechanic skilled in the art. But it is plain from the evidence, and from the very fact that it was not sooner adopted and used, that it did not, for years, occur in this light to even the most skillful persons. It may have been under their very eyes, they may almost be said to have stumbled over it; but they certainly failed to see it, to estimate its value, and to bring it into notice * * *. Now that it has succeeded, it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest

merit. It may be laid down as a general rule, though perhaps, not an invariable one, that if a new combination and arrangement of known elements produce a new and beneficial result never attained before, it is evidence of invention.' "

Bates v. *Coe*, 98 U. S. 48;

Parks v. *Booth*, 102 U. S. 96;

Imhaeuser v. *Buerk*, 101 U. S. 647; affirming *Bates* v. *Coe*.

Cantrell v. *Wallick*, 117 U. S. 689:

"The first defense is based on the theory that a patent cannot be valid unless it is new in all its elements as well as in the combination, if it is for a combination. But this theory cannot be maintained. If it were sound no patent for an improvement on a known contrivance or process could be valid. And yet the great majority of patents are for improvements in old and well-known devices, or on patented inventions. Changes in the construction of an old machine which increase its usefulness are patentable. *Seymour* vs. *Osborne*, 11 Wall. 516. So a new combination of known devices, whereby the effectiveness of a machine is increased, may be the subject of a patent. *Loom Co.* vs. *Higgins*, 105 U. S. 580; *Hailes* vs. *Van Wormer*, 20 Wall. 353," etc., etc.

New mode of operation. This general doctrine is particularly emphasized, when as in the patent in suit, the old elements co-operate with a new mode of action. Spinning-rolls were old. Ring-cores were old. But they had never been used before in the peculiar relations in which State employed them, wherein the core was rotated at a sufficiently high speed and sufficient centrifugal force was created to throw the fabric skirts out from its sides, while the roll in its radial movement acted upon the thrown-out skirts to stretch them radially and to shape and apply them to the sides of the core.

Especial stress is laid on this doctrine because of

defendant's insistent contention that State is endeavoring to cover a method or "art". There is a vast difference between an "art" and a "machine" characterized by a new mode of operation.

The text books treat the principle as well established. *Walker*, § 37, p. 49, says that "an old combination with a new mode of operation may be an invention." *Hopkins*, p. 79, and *Robinson*, Vol. I, § 155, p. 219 *et seq.* (and cases cited) speak to the same effect.

A leading case is *Keystone* vs. *Adams*, 151 U. S. 139, wherein the Adams patent covered a corn sheller, against which two other patents were set up as anticipatory, one of them being to the patentee's father. In all three machines the combinations, considering the elements merely, were precisely the same. Among these elements in each machine there was a rotating shaft provided with wings. In the earlier machine, and to prevent the clogging of the throat of the sheller, the shaft was rotated rearwardly to hold the ears of corn back. But this arrangement retarded the operation of the shelling machine. Therefore, the patent in suit rotated the shaft in a forward direction and the difficulty was overcome. There could be no clearer case. From the standpoint of construction and of the devices employed therein, the combinations were precisely the same. All that the patent in suit did was to reverse the direction of the rotating shaft. In this way the mode of action was altered and the combination of old parts became a new combination. The opinion says:

> "* * * While it is true that the device patented by Augustus Adams, the father of the present patentee, in May, 1866, was intended to effect the same purpose, and used likewise a revolving shaft with wings or protuberances, *yet the mode of operation was entirely different.*"

And at a later point:

> "It must be admitted that both of these patents granted to Augustus Adams, one in 1861, and the

other in 1866, describe mechanical contrivances closely resembling the invention in question, patented by H. A. Adams, October 15, 1872. There is present in all three machines a rotating shaft with spurs or wings, and the purpose sought to be effected is the same.

But, as we have seen, when the test of practical success is applied, the conclusion is favorable to the last patent.

Where the patented invention consists of an improvement of machines previously existing, it is not always easy to point out what it is that distinguishes a new and successful machine from an old and ineffectual one. But when, in a class of machines so widely used as those in question, it is made to appear that at last, after repeated and futile attempts, a machine has been contrived which accomplishes the result desired, and when the Patent Office has granted a patent to the successful inventor, the courts should not be ready to adopt a narrow or astute construction, fatal to the grant."

The same holding has been made in many other cases, although nowhere is the principle more clearly expressed. An instance is:

Seymour v. *Osborne*, 78 U. S. 516:

"Particular changes may be made in the construction and operation of an old machine so as to adapt it to a new and valuable use not known before, and to which the old machine had not been, and could not be, applied without those changes and, under those circumstances, if the machine, as changed and modified, produces a new and useful result, it may be patented, and the patent will be upheld under existing laws. *Bray* v. *Hartshorn*, 1 Cliff. 541; *Losh* v. *Hague*, 1 Web. Pat. Cas. 207; Hind Pat. 95; *Phillips* v. *Page*, 24 How. 166 (65 U. S. XVI, 640); Norm. Pat. 25.

Such a change in an old machine may consist merely of a new and useful combination of the several parts of which the old machine is composed, or

it may consist of a material alteration or modification of one or more of the several devices which entered into its construction, and whether it be the one or the other, if the change of construction and operation actually adapts the machine to a new and valuable use not known before, and it actually produces a new and useful result, then a patent may be granted for the same, and it will be upheld as a patentable improvement. *Park* v. *Little*, 3 Wash. (C. C.) 196."

But there is need of referring to but one other case in this Court to show that the mode of operation or functioning of the elements of a combination claimed may properly have a modifying effect on the combination itself, without laying the claim open to the objection of being for a process or method.

This is the very recent case of *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, decided by this Court February 19, 1923 (43 Sup. Ct. Rep., 322). The invention of Eibel was an improvement in Fourdrinier machines for paper making. The separate elements that went to make up the patented combination were old and, indeed, the combination of them was old, if the peculiar way in which they co-acted was ignored.

The Court found the gist of the invention to reside in the maintenance of the breast-roll end of the paper-making wire of the machine at a substantial elevation above the level, and the provision of means for regulating the speed of the machine so as to cause the wire to travel at substantially the same speed as that of the rapidly moving stock due to the elevation of such breast-roll end of the wire.

One of the claims in suit was as follows:

"2. A Fourdrinier machine having the breast-roll end of the paper-making wire maintained at a high elevation, whereby the stock is caused to travel by gravity faster than the normal speed of the wire for

a certain grade of stock, and having means for increasing the speed of the machine to cause the wire to travel at substantially the same rate of speed as the rapidly-moving stock, substantially as described."

Notwithstanding the recitation of the functions and mode of operation of the several elements claimed in combination, this claim was held to be for a *machine* and not for a method or process.

The difficulty of setting forth, in the form of a claim, the real invention of the patentee was doubtless appreciated by the Court, but, in view of what the Court found to be the novel advance in the art attributable to Eibel, no difficulty was encountered in interpreting the claim to cover that invention.

The case is so recent that further discussion of it, here, would be out of place.

In the light of the foregoing authorities, let us again consider the combination which State brought into the art, viz.

(*a*) a rapidly rotating core upon the periphery of which the strip of fabric is applied and circumferentially stretched and by the rotation of which the skirts of the fabric are violently thrown out by centrifugal force to render them puckerless, wrinkleless and taut,

(*b*) spinning rolls for acting upon the outflung skirts of the fabric at their attached or hinged portions,

(*c*) hinged supports for the spinning rolls,

(*d*) power pressure means applied to the spinning roll supports for keeping the spinning rolls to their work under preregulated pressure,

(*e*) a radially sliding carriage running on fixed guides, upon which carriage the spinning roll supports are mounted, for compelling the traverse of the spinning rolls invariably in right lines,

(*f*) and means (the screw feed) for positively and regularly advancing the spinning roll carriage in its fixed path of movement,

whereby the power-pressed spinning rolls are applied to the centrifugally outflung taut skirts of the fabric from the hinge portions toward the edges thereof in always advancing definite spiral lines of contact, resulting in the uniform radial stretching of the meshes of the skirts of the fabric and the close application of said skirts through the bead zone of the tire, without the puckering or wrinkling of the fabric at any point.

Not only is this an entirely new combination, but the elements cooperate with a new mode of action and produce a new result.

The Disclaimer.

Sections 4917 and 4922 of the Revised Statutes afford means whereby a patentee who has made his claims too broad may reduce them by disclaimer to correspond to the real scope of his invention. Plaintiff has taken advantage of these provisions to limit the claims of the patent in suit so that they will cover no more than what State actually invented, *i. e.*, the patent has been so narrowed that all extraneous matter has been eliminated and the claims confined to the particular combination previously defined.

The Courts have said that covering the matter in two distinct sections was not the best variety of statute writing and that they should have been combined in one clear and comprehensive statement. However, this defect has been remedied by construing them together. The leading authorities are *Hailes* v. *Stove Co.*, 123 U. S. 588, and *Sessions* v. *Romadka*, 145 U. S. 41. The resulting joint interpretation is well established and is given in the text books as well as in the cases. For instance, *Walker* (5th Edition, p. 264, § 193) states the purpose:

> "Whenever through inadvertence, accident or mistake, and without any fraudulent or deceptive

> intention, a patentee has, in his specification, claimed materially more than that of which he was the first inventor, his patent shall be valid for whatever is justly his own; and every such patentee, his executors, administrators, or assigns, whether of the whole or any sectional interest in the patent, may maintain a suit at law or in equity, for the infringement of such part, if it is a material and substantial part of the thing patented, and is definitely distinguishable from the parts claimed without right."

To secure this result, the proper disclaimer has been made, and it will be found at page 13, Vol. 2. It was filed February 14, 1919, after the bill of complaint herein. The practice of filing a disclaimer during the pendency of an action is entirely proper and has been approved many times by this Court:

Smith v. *Nichols*, 88 U. S. 112;
O'Reilly v. *Morse*, 15 How. 62;
Dunbar v. *Myers*, 94 U. S. 193;
Hailes v. *Albany*, 123 U. S. 582;
Carnegie v. *Cambria*, 185 U. S. 436;
Wilson v. *Chicago*, 105 U. S. 566.

One of the necessary requisites of such a disclaimer is that it shall be entered without unreasonable neglect or delay. That question does not arise here, as it was first prompted by the result of the litigation in the Sixth Circuit and was filed two months after the opinion of the Court of Appeals for the Sixth Circuit, in fact on the same day that the final decree was entered. Before that decree, there was no formal settlement as to the pertinence of the defenses relied on, such as the Mathern Belgian patent. We refer to the Mathern patent merely by way of convenient example and do not admit that it has significant bearing. It has been judicially held that there is no admission "that the subject of the disclaimer appears in the prior art, which may not by any means

be the case, nor is there any justification for so construing it." *Manhattan* v. *Helios*, 135 Fed. 785, 802. Defendant's repeated assertions to the contrary are without authority.

These conditions also dispose of defendant's contention that there is insufficient proof of "inadvertence, accident or mistake". Walker (p. 265, § 195) covers the topic rather completely:

> "*Mistakes of fact, relative to how much of a described process, machine or manufacture was first invented by its patentee, frequently follow from lack of full information touching what was previously invented by others. Litigation may alone disclose the fact that the patentee's claims are too numerous or too broad to be consistent with novelty.* Whenever this occurs, it is clear that the patentee ought no longer to appear to hold an exclusive right to anything which he was not the first to invent. To this end, the statute provides that he must disclaim that part, within a reasonable time, or, in default thereof, must suffer the statutory consequences. *On the other hand, it is equally clear, that if the patentee is willing to eliminate from his claims, everything which later information shows had been invented before him, he ought to be allowed to retain his exclusive right to the residue.* To this end, the statute provides that if within a reasonable time, he disclaims what was another's, he shall be enabled to enforce his patent as far as it covers what was his own invention."

By way of anticipation, as the subject will be discussed later, there is of course a limit to a patentee's rights under these disclaimer statutes. While he is at liberty to cut and pare down his claims, he is not permitted to change the nature of the invention. The diminution must be quantitative rather than qualitative. He cannot alter the character of the claims by the introduction of different elements. He cannot import into the claims characteristics that are not warranted by the

specification. When alterations of this latter kind are to be made, they must be sought by reissue rather than by disclaimer, the leading authority being *Hailes* v. *Stove Co., infra.* However, the present disclaimer is quite free from attack in these particulars.

Terms of disclaimer. The disclaimer may be conveniently considered under three distinct heads,—*a.* Clauses "First", "Second" and "Third"; *b.* Clause "Fourth"; and *c.* Clause "Fifth". The two latter heads will be first disposed of.

Clause "Fourth". The Court of Appeals for the Sixth Circuit held that it was aggregation to claim the tread roll in combination with the spinning-rolls, etc. Whether or not this finding be correct, the disclaimer eliminates all claims embodying the tread-forming roll, namely, Nos. 8, 9, 10, 11 and 14, so that the tread roll disappears from the case. In addition, claims 15, 16 and 17, relating to subsidiary features not connected with the skirt-forming devices, such as the muslin take-up roll, were eliminated. The cancellation of entire claims in this manner has been approved by this Court.

O'Reilly v. *Morse*, 15 Howard, 62;
Sessions v. *Romadka*, 145 U. S. 41.

Defendant argues, but without proper basis, that the disclaimer of the claims Nos. 8, 9, 10, 11 and 14 has the effect of erasing other claims in suit, basing its theory on the allegation that these disclaimed claims are more limited than those retained and that the surrender of the narrower ones necessarily eliminates the broader ones. There is no ground for this contention. It has already been pointed out that each of the specified claims included the tread roll as an element. In other words, they were for a *totally different combination.* In fact, the Court of Appeals for the Sixth Circuit said that because

of the inclusion of the tread roll there was no combination at all, but rather aggregation. It was in part to meet this objection that the claims were taken out. There was no erasure of claims, whether of broader or narrower scope, embodying the principal combination retained. Defendant's premises give no support to its theory. In addition, it has been often held that each claim in a patent stands by itself and is in effect a patent by itself. Moreover, the two cases last cited above are ample authority for the disclaimer of individual claims which are void or objectionable for other reasons.

Clause "Fifth". On lines 72 to 80 of page 1 of the specification, it is stated that the combination of the tread roll and the spinning-rolls is "an important feature of my invention". In view of the cancellation of the tread roll claims, the quoted words have been also eliminated. On lines 92 to 96 of page 1, the muslin take-up roll is referred to "as another feature of my invention". Claim 15 related to the take-up roll and has been disclaimed. Therefore, the quoted language has also been eliminated. Numerous authorities hold that too broad statements in the specification may be cancelled by disclaimer.

Carnegie v. *Cambria*, 185 U. S. 436;
Hurlbut v. *Schillinger*, 130 U. S. 456;
Wilson v. *Chicago*, 105 U. S. 566.

Clauses "First", "Second" and "Third". These three clauses constitute the really important part of the disclaimer in that they bring out State's real invention, and thus cut out matter which may have been embraced by too broad and comprehensive language; and also they dispose finally of "aggregation" as suggested by the Court of Appeals for the Sixth Circuit.

As the claims in suit are closely related, it is believed that the discussion of a single one will suffice, and for

that purpose we have selected No. 22 almost at random. After referring preliminarily to the "sheet-fabric supply", which indicates that sheet-fabric is acted upon, the combination sets forth,—

> "a power-driven ring-core,
>
> a radially moving support laterally power-pressed toward the core, and
>
> a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core".

In this connection, it is important to bear in mind the established legal principle, as to which authorities have been previously given,—that bringing together old elements with a new mode of action constitutes *a new combination* (*Eibel* case, *supra*).

In our examination of the selected claim, and referring to the language of clause "Third" of the disclaimer,

(*a*) It is first stated that the recited elements are "constructed and co-ordinated for shaping and applying a previously unshaped sheet fabric supply to that part of the recited ring-core beyond the tread portion". This is by way of preface, and merely gives the purpose as set forth in the specification. The individual elements are next taken up.

(*b*) It is then stated that "the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core". In the claim as it originally stood, there was no direct reference to the speed, and this is now stated, thus ascribing the proper co-operative action to the core.

(*c*) And it is finally stated that the spinning-roll "in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrif-

ugally thrown-out fabric, to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith". In the claim as it originally stood, while the spinning-roll is said "to shape the sheeted fabric on the core", there was no reference to its action upon the "centrifugally thrown-out fabric". This is now stated, thus ascribing the proper co-operative action to the roll.

Let us compare this more completely stated organization with that disclosed in the Mathern patent, selected as an example of the prior art, although it is again noted that the disclaimer does not admit its pertinence (*Manhattan* vs. *Helios, supra*). For instance, in the Mathern patent the roll is not "power-pressed" but held manually against the core; and it does not "shape the sheeted fabric on the core"; and in addition the support is of a different nature in that instead of effecting the advance of the roll, it really restrains it. However, ignoring differences like these, Mathern did have a power driven ring-core of uncertain speed, some kind of a movable support, and what the Court of Appeals christened "a spinning-roll". State has three elements which are called by the same names, and there the resemblance begins and ends, since the Court "is not to judge about similarities or differences *by the names of things*" (*Machine Co.* v. *Murphy*, 97 U. S. 120). The parts co-operate in a totally different fashion and the disclaimer sets forth the mode of action.

If the original references merely to a core, and merely to a roll to pass radially along its sides, were too broad and comprehensive, in that they did not specifically differentiate from cores *per se* and rolls *per se* in the prior art, the objection has certainly been removed by the disclaimer, which has the combined effect of limiting the claim to its proper scope, of distinctly specifying the new mode of action which characterizes the State invention and of disposing of the theory of "aggregation".

And, as already pointed out, there is ample support in the specification for the functions ascribed by the disclaimer to the core and roll. This is practically admitted by defendant. There is the reference to a speed of 207 R. P. M., which is quite adequate to produce the centrifugal effect. There is the statement that "the centrifugal force tends to throw the fabric out at a right angle from the core plane", and it is so shown in Fig. 12^b. It is said that the rolls "by radial motion with respect to the ring-core gradually press the canvas in contact with the sides of the ring-core toward its internal periphery to shape the sides of the tire" and that they "have been found particularly efficient in shaping the sides of the tire shoe and form an important feature of my invention." And there is much more of similar significance that need not be repeated. Even though the complete scientific explanation be not given, there is a full description of the mechanism; and that is all the law requires under the authorities previously noted. No new element has been added. The recited elements remain unchanged. There is merely a statement of their co-operative relations and of the new mode of action. This is well within the practice permissible under the Statutes. The Court of Appeals for the Sixth Circuit must have found differently, if it had been dealing with the present state of facts.

Instances of proper disclaimer. The Courts have always been liberal in approving disclaimers designed to reduce the scope of claims, provided that no new elements are introduced, that the intrinsic nature of the invention be not altered, and that there be a proper basis in the specification. Some of these cases will now be examined.

Silsby v. *Foote*, 14 How. 218:

This is a well known authority and has been often cited. Its particular interest resides in the fact that the disclaimer diminished the scope of the claims *by stating the mode of action* of the elements therein without other change. The invention related to a stove provided with a damper and also with a metallic rod which by thermostatic action opened and closed the damper. The claim was too broad, the significant portion being as follows:

> "*the application of the expansive and contracting power of a metallic rod, by different degrees of heat,* to open and close a damper which governs the admission of air into a stove."

The italicized language was too general, and the claim was met verbally by the prior art, wherein it was old to govern the dampers of stoves and furnaces by thermostats subjected to the heat of a room. The real invention involved the location of the thermostatic rod in the stove itself, and so the scope of the claim was cut down by a disclaimer which stated that "such rod shall be acted upon directly by the heat of the stove or the fire which it contains." In other words, the old elements remained the same, but the combination was restricted *by a statement of their cooperative relations and of their new mode of action.* The State disclaimer is in the same category.

Permutit Co. v. *Harvey Co.*, 279 Fed. 713, 721 (2nd C. C. A.):

This is another and very recent instance of a claim being saved by a disclaimer setting forth a new mode of action of old elements. The invention related to water-softening or filtering apparatus, and it was discovered that a similar arrangement of the same parts had been previously used for the same purpose. Thereupon, a disclaimer was filed which limited the claim to the *downward* passage of the water to be softened,—in other words,

reversing the flow as compared with that in the older apparatus. Speaking of the disclaimer, the Court said:

> "It was intended by this to exclude from the scope of claim 1 the apparatus in which the water to be softened passes upwardly through the layer of zeolite. By this nothing was injected into the patent as argued by the appellants. This action was taken for the purpose of limiting its effect. The power to disclaim is a beneficial one, and should not be denied, except where a fraudulent and deceptive purpose is apparent. *Sessions* v. *Romadka*, 145 U. S. 29, 12 Sup. Ct. 799, 36 L. Ed. 609. We find no evidence of such purpose here."

An analysis of the opinion will indicate close parallelism to the facts at bar.

Butte v. *Minerals Separation*, 250 Fed. 241, 249; *Minerals Separation* v. *Butte*, 250 U. S. 336.

There was much litigation in this matter, but the two cases noted, respectively, before the Court of Appeals for the Ninth Circuit and this Court, are sufficient for our purposes. The patent related to improvements in the concentration of ores, the object being to separate the metalliferous material from gangue by the use of oils and the like. This was broadly old, but the patentee discovered that very much better results could be secured by using the oil in much reduced quantity. This Court had previously held claims 9, 10 and 11 invalid since they merely prescribed a "small quantity of oil", which the Court regarded as "a wholly indefinite quantity". Therefore, in order to bring out the real invention, a disclaimer was filed limiting the amount "to a fraction of 1 per cent. on the ore". The use of a small quantity like this was the real discovery, and in addition it differentiated from the prior art wherein more than one per cent. had been employed. Moreover, the Court held that a delay of three

and one-half months in filing the disclaimer was not excessive. The other and subsequent findings on the questions of infringement, etc., do not affect the situation. All we are concerned with is the nature of the disclaimer. The Courts held that a statement of the reduced amount of oil was sufficient. The State disclaimer indicates an increased core speed to obtain the requisite centrifugal force.

There have been numerous instances where limiting disclaimers of various kinds have been approved. To avoid undue prolixity some of them will be referred to in condensed form:

Thompson v. *Bushnell*, 96 Fed. 238:

The patent was for an improvement in sawteeth and was broadly claimed in connection with "a saw". Such teeth had previously been employed in connection with circular saws and hack saws. The disclaimer limiting the invention to hack saws and band saws was sustained.

Terry Co. v. *New Haven Co.*, 17 O. G. 909:

The patent related to clocks and the claim covered a combined dead-beat and recoil escapement. This was broadly old and the claim was invalidated. Subsequently there was a disclaimer limiting the claim to such an escapement when "produced from flattened metal by bending". The claim was then sustained and held infringed.

Lockwood v. *Hooper*, 24 Fed. 910:

The claim was for "a rubber eraser having soft finished erasive surfaces". This was old broadly, but it was new to produce such a surface "by tumbling the eraser". The disclaimer was held good.

Roemer v. *Neumann*, 26 Fed. 102:

The patent related to a lock and the claim was invalidated. Certain notches were an important feature, and by disclaimer they were read into the claim. The disclaimer was held proper. The last statement is based on information contained in *Electrical Co.* v. *Julien*, 38 Fed. 117, see page 136.

Libby v. *Mt. Washington*, 26 Fed. 757:

The claim was for a method of making glass articles of different colors and was old broadly considered. The patentee was allowed to limit it by disclaimer to the use of the described gold-ruby compound.

Electrical Accumulator v. *Julien*, 38 Fed. 117:

The invention was a most important one and related to a storage battery, wherein the claimed electrode consisted of a support coated with "an active layer of an absorptive substance". This was broadly old, but it was new to apply the absorptive substance "in the form of a paint, paste, or cement", and in order to save the valuable patent, the Court itself suggested the disclaimer. The opinion contains an interesting discussion of the authorities and practice.

Page v. *Dow-Jones*, 200 Fed. 72:

The patent was for a printing telegraph machine, but the claim was too broad in that it related to a "constantly acting source of power". The disclaimer changed this to "constantly rotating drive shaft", and the claim was held valid and infringed. In this opinion also there is an enlightening discussion of the general subject.

Marconi v. *DeForest*, 243 Fed. 56:

The patent covered a detector used in wireless telegraphy, and after filing its bill, the plaintiff entered the following disclaimer:

> "To the combination of elements set forth in claim 1 * * * *except as* the same are used in connection with high-frequency alternating electric currents or electric oscillations of the order employed in Hertzian wave transmission."

Certain words in the specification referring to low frequency currents were also disclaimed. The disclaimer was upheld and numerous cases cited in support of the ruling.

Aiken v. *Dolan*, 3 Fisher, 197:

The mechanism involved was a knitting machine, and the claim covered "a latch or tongue applied to the hook of the needle", which was not new in itself. But it was suggested by the Court that a disclaimer could be filed limiting the claim to latch needles with a certain curvature.

Tuck v. *Bramhall*, 6 Blatch. 95:

The claim was for a canvas piston packing in the form of a roll having a rubber core, *or without it*. This made the claim too broad, but a disclaimer limiting the claim to the forming of the roll *with the core* was held good.

Taylor v. *Archer*, 8 Blatch. 315:

The claim was for "the use and application of glue, or glue composition", in the manufacture of flexible tubing. It was old to use glue for the purpose, and the Court approved a disclaimer eliminating glue and limiting the claim to "glue composition".

There are numerous analogous cases wherein the scope of too broad a claim has been limited by the cancellation of statements in the description. Among them are:

Hurlbut v. *Schillinger*, 130 U. S. 456;
Carnegie v. *Cambria*, 185 U. S. 403;
Simplex v. *Pressed Steel*, 189 Fed. 70.

There are some cases wherein patents have been invalidated after disclaimer for reasons not relating to the propriety of the disclaimer itself. Among these are:

Smith v. *Nichols*, 88 U. S. 112;
Dunbar v. *Meyers*, 94 U. S. 193;
Wilson v. *Chicago*, 105 U. S. 566;
Brunswick v. *Klump*, 131 Fed. 255;
Bracewell v. *Passaic*, 107 Fed. 467.

Defendant's position. The principal defense as to the disclaimer is given in paragraph XXVI of the answer, viz., that the changes should "have been made by way of reissue", and that it was "unreasonably delayed". The latter has already been disposed of.

The *reissue* contention applies *only when the nature of the invention* rather than the scope of the claim has been altered, as by the attempted introduction into it of new elements, or where the statements in the disclaimer are not supported by the description in the specification. Neither of these conditions exists here.

Hailes v. *Stove Co.*, 123 U. S. 582, is the leading case. The Hailes patent was for a stove, and the original claim in question was as follows:

> "1st. Arranging a perforated firepot with a grate bottom within a circular stove having provision for the admission of air below the point of suspension of said firepot, substantially as described."

The Court held it anticipated and invalid. Thereupon, an effort was made to introduce in place of it a totally

new claim covering a different invention, and this was attempted under the guise of a disclaimer, which said in part as follows:

> "the material or substantial part of the thing patented in and by said claim *not hereby disclaimed* being as follows:
>
> > 'A firepot suspended from its upper edge with substantially the upper half of its sides made solid, and substantially the lower half of its sides containing perforations or openings.' "

The Court held that there was no support for the new claim in the specification:

> "* * * There is no word, or hint, in the patent, that the invention claimed was a firepot with sides grated only half way, or part of the way from the bottom towards the top, or that such partially grated sides have any advantage over those grated all the way to the top. The first claim, as modified by the disclaimer, has nothing in the specification to stand upon, nothing to explain it, nothing to furnish a reason for it."

The opinion further points out that where an amended or supplemental description is necessary to make the altered claim intelligible, the relief must be sought by reissue:

> "* * * A disclaimer is usually and properly employed for the surrender of a separate claim in a patent, or some other distinct and separate matter, which can be exscinded without mutilating or changing what is left standing. Perhaps it may be used to limit a claim to a particular class of objects, *or even to change the form of a claim which is too broad in its terms;* but certainly it cannot be used to change the character of the invention. And if it requires an amended specification or supplemental description to make an altered claim intelligible or relevant, whilst it may possibly present a case for a surrender and reissue, it is clearly not adapted to a disclaimer."

Surely no such objections as these can be urged against the State disclaimer. The elements remain unaltered, and there is ample support in the specification for the new mode of action attributed to them. All that has been done was "to change the form of a claim which is too broad in its terms", as stated by the Court.

Electrical Accumulator v. *Julien*, 38 Fed. 117, 136, in its general discussion of the cases refers to *Hailes* v. *Stove Co.* as follows:

> "* * * In that case there was nothing in the specification to indicate to the public that the invention of the patentee was what he sought to make it by the disclaimer. He claimed 'a perforated fire-pot', etc., and when he found that this was old he sought by disclaimer to limit his invention to a particular kind of fire-pot, described for the first time in the disclaimer."

Grant v. *Walter*, 148 U. S. 547, 557, gives another illustration of what this Court had in mind:

> "* * * So that, under the operation of the disclaimer, the specification and claims would have to be read as addressed to the dyer rather than to the skein-maker. This would involve a complete change of what was covered by the specification and claims, which must be held controlling."

National v. *Stetcher*, 81 Fed. 395, 399. The disclaimer was not technically in the case, although the opinion discusses it in the following language:

> "* * * An examination of the proposed disclaimer will, we think, disclose that a strong argument could be made in favor of the proposition that with the exception of the requirement that the channel should be recessed out of 'firm' paper or other material, the limitations or the requirements of the disclaimer point to an invention which would require an amended specification or a supplemental description."

It cites *Hailes* v. *Stove Co.*

Albany v. *Worthington*, 79 Fed. 966, 969, is an illustration of an attempt to introduce a new element by disclaimer. Complainant disclaimed "any apparatus, as included in the claims of said patent, which is not directly connected with the return pipe, H", etc., as to which the opinion says:

> "* * * The difficulty with this contention is that it substitutes a different invention from that described and claimed in the patent. It is not a narrower claim, but a different one. It is, as defendants suggest, 'an attempt to incorporate into a claim for a combination a feature which had not been claimed in connection with that combination before, and thereby make a new combination.' "

Strause v. *Crane*, 235 Fed. 126, 129, also is an instance of the attempted introduction of a new element into the claims. The opinion says:

> "* * * Nothing whatever was said in either claim about the air outlet passages;"

and at another point:

> "* * * To introduce that element into the claims was therefore to provide a differentiation not suggested anywhere, unless it be in the figures themselves;"

and again:

> "* * * We do think, however, that the differentiation afterwards incorporated into the claims must appear somewhere in either figures or specifications, and that unless it does the disclaimer becomes no more than a making over of the whole patent."

There are no new elements introduced by the State disclaimer, nor is there any statement therein not having full support in the specification. Its only effect is to narrow the scope of the claim. Reissue was not neces-

sary; disclaimer was the proper remedy along the lines of the authorities first cited.

Permutit Co. v. *Harvey Co.*, 274 Fed. 937, already referred to as supporting a disclaimer based upon the specification of a different mode of action, is pertinent here also:

> "The limitations imposed by the disclaimer have not altered the description as originally filed by the patentee or in any way changed the claim, except to narrow its scope. The Supreme Court in the case cited above also said that the power to disclaim is a beneficial one, and should not be denied to an inventor, except where the power is used for a fraudulent or deceptive purpose. Such I find was not the purpose in filing the disclaimer herein."

Court of Appeals for the Third Circuit on the Disclaimer.

Regarding the matter of the disclaimer, the Circuit Court of Appeals for the Third Circuit, in the present case, had this to say:

> "Seeing, then, that State's contribution to the tire-making machine art was novel and useful, that it passed into general use and that its worth and the validity of his patent have been acquiesced in by large numbers of manufacturers in the automobile industry, who naturally would not pay tribute unless they were satisfied of the validity of his patent, we turn to the question whether such a meritorious patent is to be invalided as held by the Court below, on account of the disclaimer State filed after the decision in the Sixth Circuit. We cannot give the disclaimer that effect.
>
> "Experience has shown that very often applicants for patents, impressed by the seeming importance of their own inventions, have made statements and claims which time and closer knowledge of the art show are unwarranted. In relief of such common

mistakes, the disclaimer statutes allow a patentee to seasonably avow such unwarranted statements and unjustified claims, and to restrict and narrow his application to the limits of the real, novel, disclosure he made, and to confine his claims to that limit. Where a disclaimer is filed in good faith, and no attempt is made thereby to broaden or make more inclusive the original disclosure or claims, the law looks with favor on such procedure. In this case, there is no element of fraud, bad faith or an attempt to broaden the disclosure or claims, but an honest effort to eliminate from the specification and the construction of the claims all elements save those which constituted the true disclosure State gave the art.

"*Broadly speaking, the essence of State's invention consisted of the combination of a power-driven core, with spinning rolls mounted on a radial, moving support, the rolls being so laterally spring-pressed as to compel them to follow the lessening contour of the shoe down to the bead edge.*

* * * * * *

"As to the claims which are here in suit and which embody the essential elements of State's disclosure, there was no abondonment of them but simply an assertion of and emphasis upon those vital elements which we have indicated. For example, take claim 22, which embodies the elements of, first, a power-driven ring core; second, a radially moving support laterally power-pressed toward the core; and third, a spinning roll mounted on a support for passing radially along the sides of the tire-shoe, to shape the sheet of fabric on the core. The effect of the disclaimer is to restrict the operation of these elements to that part of the ring core beyond the tread portion. In that respect, the disclaimer states that in respect to Claim 22:

> 'I hereby disclaim any combination of the recited elements *except when* constructed and coordinated for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent

> centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning roll in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.' "

In the *Eibel* case, had Eibel drawn his second claim, hereinbefore quoted, with bare elements stated and functions and mode of operation omitted, so as to read:

> "2. A Fourdrinier machine having the breast-roll end of the paper-making wire maintained at a high elevation * * * and having means for increasing the speed of the machine * * *, substantially as described."

We make no doubt that this Court would have looked favorably upon a disclaimer which qualified the first element of the claim as applying *only when* "the stock is caused to travel by gravity faster than the normal speed of the wire for a certain grade of stock", and which qualified the second element of the claim as applying *only when* acting "to cause the wire to travel at substantially the same rate of speed as the rapidly-moving stock", in view of what this Court found to be the real invention of Eibel.

State's disclaimer should, we submit, be, in this case, regarded with equal liberality and favor.

The decree below should be affirmed.

Respectfully submitted,

MELVILLE CHURCH,
LUTHER E. MORRISON,
Counsel for Respondent.

January 10, 1924.

JAN 2 1923
WM. R. STANSBURY
CLERK

Supreme Court of the United States,

OCTOBER TERM, 1922.

No. 774

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

PETITION FOR WRIT OF CERTIORARI AND BRIEF.

TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

LIVINGSTON GIFFORD,
THOMAS G. HAIGHT,
E. CLARKSON SEWARD,
Counsel for Petitioner.

The Evening Post Job Printing Office, Inc., 154 Fulton St., New York, N. Y.

INDEX.

	PAGE
PETITION FOOR WRIT OF CERTIORARI.....	1–9
BRIEF IN SUPPORT OF PETITION.....	11–20
Grounds for the Application for Writ of Certiorari	11
Argument	13
Conclusion	20
APPENDIX A:	
Opinion of U. S. Circuit Court of Appeals, Sixth Circuit	21
APPENDIX B:	
Disclaimer	45
APPENDIX C:	
The State Patent in Suit.....	48
Prior Hand Operation.....	50
Mathern Belgian Patent.....	51
NOTICE OF SUBMISSION	53

Supreme Court of the United States,

OCTOBER TERM, 1922.

No.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

PETITION FOR WRIT OF CERTIORARI.

TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

TO THE HONORABLE THE SUPREME COURT OF THE UNITED STATES:

The Petitioner respectfully represents to this Honorable Court as follows:

This is a patent suit in which the Circuit Courts of Appeals for the Sixth Circuit and Third Circuit have respectively held that the same claims of the State patent No. 941,962, dated November 30, 1909, are invalid and valid, and the object of this Petition is to have the Supreme Court settle this conflict.

The Court of Appeals for the Sixth Circuit has decided that there was *no novelty* or *invention* in the machine described in the State patent and claimed in said claims, whereas the Court of Appeals for the Third Circuit has since held that there *is novelty* and *invention* and sustained the patent. As a result of this conflict, a very great number of automobile tire manufacturers throughout the United States are placed in a dilemma, from which they can be relieved only by an authoritative decision of this Court. The facts are as follows:

1. This suit, alleging infringement of the patent to State, No. 941,962, granted November 30, 1909, for "Pneumatic Tire Shoe Manufacturing Machine" * (Rec. Vol. II, p. 1), was brought by the Respondent, Frank A. Seiberling, owner of said patent, in the District Court of the United States for the District of New Jersey, against the Petitioner, The John E. Thropp's Sons Company, by Bill of Complaint filed April 11, 1914, and Amended Bill of Complaint filed May 13, 1914 (Rec. Vol. I, p. 1).

2. Said United States District Court, in a Final Decree entered February 21, 1922 (Rec. Vol. I, p. 631) dismissed the Bill of Complaint.

3. The Respondent appealed to the United States Circuit Court of Appeals for the Third Circuit, which appeal came on for hearing before Buffington, Woolley and Davis, Circuit Judges, and the Court, on October 19, 1922, filed its Opinion (*Davis, Circuit Judge, dissenting*) reversing the Decree of said District Court and finding the

* The patent is briefly explained, Appendix C, p. 48.
Italics throughout are ours unless otherwise noted.

patent to be valid and infringed. Petition for Reargument (Rec. Vol. I, p. 658) was duly filed on November 16, 1922, setting forth that the majority of the Court had based its decision on an assumption of fact which was not supported by any evidence in the record and which was contrary to established laws of physics, the last point being supported by the affidavits of the Professor in charge of Experimental Engineering at the University of Pennsylvania, the Dean of the Engineering School at the University of Columbia, and the Head of the Mechanical Engineering Department at Stevens Institute of Technology. Respondent filed an Answer to this Petition for Reargument (Rec. Vol. I, p. 677) in which there was no denial of the facts set forth in said affidavits. This Petition was denied, *without Opinion*, on December 4, 1922.

4. Prior to the decision in this suit, said State patent had been held invalid by the Circuit Court of Appeals for the Sixth Circuit (Warrington, Knappen and Denison, Circuit Judges) in a suit brought April 22, 1914, in the District Court of the United States for the Northern District of Ohio, Eastern Division, by the Respondent against The Firestone Tire & Rubber Company. In the said District Court, the patent was sustained, and thereafter an appeal was taken to said Circuit Court of Appeals for the Sixth Circuit. After the case was argued before said Court of Appeals, new evidence, in the form of a Belgian patent, was discovered by that Defendant and presented to the said Court of Appeals, which thereupon ordered the case remanded to the District Court to be reopened for additional proofs on the subject of the Belgian patent, unless the parties within fifteen

days otherwise disposed of the matter by stipulation (245 F. R. 937). A stipulation was thereupon entered into by which the Belgian patent and explanatory affidavits were incorporated in the record and the case argued before the said Court of Appeals for the Sixth Circuit a second time. On December 13, 1918, said Circuit Court of Appeals for the Sixth Circuit rendered an Opinion holding said State patent invalid. For the convenience of the Court a copy of said opinion is attached hereto as Appendix A. Thereafter the Mandate of said Court of Appeals duly issued and a Decree that the patent was invalid was entered in said District Court.

5. In the case in the Sixth Circuit, plaintiff there (Respondent here) really presented his case on the theory that the patent covered a new *method* of making tires, and that Court of Appeals expressly considered the patent from this point of view and held that this method was anticipated by the prior patent art (*e. g.*, a Belgian patent and a Seiberling & Stevens patent), as well as by the prior method of making tires by hand. The said Court of Appeals also held that, considering the patent as a *machine* patent, the claims here involved were invalid as mere aggregations.

6. Following the decision in the Sixth Circuit, Respondent filed a Disclaimer in the Patent Office on February 14, 1919. For the convenience of the Court a copy of the Disclaimer is attached hereto as Appendix B. In so far as the said Disclaimer affected the claims now involved, it constituted an attempt to, in a *formal* manner, change the said claims so as to make them cover the *same* method or mode of operation which Respondent had attrib-

uted to the said claims in the case in the Sixth Circuit, and which method or mode of operation had been held, by the Court of Appeals in the Sixth Circuit, to have been anticipated, as above recited.

7. The records before the two Courts of Appeals in the Sixth and Third Circuits were substantially the same. In both cases, Respondent relied upon the patent as covering a new method or mode of operation. In both cases, by way of defense, the defendants relied upon the prior method of making tires by hand, the Belgian patent, the Seiberling & Stevens patent, and aggregation. *In both cases, the Courts made diametrically opposed decisions on all of these issues.* The respects is which the said two Courts of Appeals differ can probably best be specifically set forth by quoting parts of their respective Opinions which deal with the same issues.

(*a*)

Respondent urged in both cases that centrifugal force was an important feature in the method or mode of operation of the State patent. On this point, the majority Opinion in the Third Circuit said (Rec. Vol. I, p. 643):

> "the *crux and dominating functional feature of State's machine* is the use upon the fabric of a *centrifugal force* caused by rapid rotation,".

On the contrary, the Court of Appeals for the Sixth Circuit said (*infra*, p. 43):

> "*Centrifugal force* is not mentioned, *in State's specification*, save as *creating an obstacle* to be avoided. * * * To make centrifugal force an effective basis of validity in the State's patent would be to give a monopoly of the spinning process or of rapid core rotation; and *each was old.*"

(*b*)

The defendants contended in both cases that the Belgian patent operated in substantially the same way as the State patent, but the Court of Appeals for the Third Circuit overruled this and said in its majority Opinion (Rec. Vol. I, p. 651):

> "Matherne [the Belgian] plastered his puckers to the core *without stretch*, and thereafter sought to roll out the puckers."

and again

> "Matherne did not touch upon or solve the problem overcome by State."

On the contrary, the Court of Appeals for the Sixth Circuit said (*infra*, p. 38):

> "the *Belgian tool* in its radial progress *was bound to stretch* and reshape the fabric *in substantially the same way that is done by State*."

(*c*)

With respect to the anticipatory effect of the Seiberling and Stevens patent the Court of Appeals for the Third Circuit said in its majority Opinion (Rec. Vol. I, p. 641) that the Seiberling & Stevens machine was

> "a machine of *wholly different type* from the one [State's] here in question."

On the contrary, the Opinion of the Court of Appeals for the Sixth Circuit said (*infra*, p. 31):

> "State's machine was of the *same general type* as Seiberling & Stevens."

(*d*)

In dealing with the question of the identity of the prior hand method and the asserted method of the State patent, the majority Opinion of the Court of

Appeals for the Third Circuit said (Rec. Vol. I, p. 643) that State invented

> "a process which is *wholly different* from the original *hand* process,".

On the contrary, the Court of Appeals for the Sixth Circuit said in its Opinion (*infra*, p. 36):

> "The evidence that this *identical* spinning operation was performed upon tire casings by *hand* tools before State's invention is sufficiently satisfying to meet all the requirements of the situation."

(*e*)

In considering the defense of aggregation the Court of Appeals for the Third Circuit in the present case stated in the majority Opinion (Rec. Vol. I, p. 645) that

> "these elements brought together and assembled for the first time by State, stamp the combination as an inventive *combination* and *not* as a *mere* mechanical *aggregation* of disjointed steps."

On the contrary, the Court of Appeals for the Sixth Circuit said in its Opinion (*infra*, p. 35):

> "This conclusion invalidates, because of mere *aggregation*, claim 4 and all the other claims of the State patent sued upon (except the fifteenth, seventeenth and perhaps the eleventh)."*

8. Although the Disclaimer filed by Respondent does nothing more to the claims here involved than to write into them the same method or mode of

* Claims 15, 17 and 11 are now out of the case.

operation which Respondent attributed to them in the case in the Sixth Circuit, and in the light of which the Court of Appeals there considered said claims and yet held them to be invalid, the said Disclaimer is in a form and to an effect which are contrary to the Statute and decisions of this Court. (Revised Statutes, Sections 4917, 4922; *Hailes* v. *Albany*, 123 U. S. 582, 587; *Grant* v. *Walter*, 148 U. S. 547, 550, 551. See also *Strause* v. *Williams*, 235 F. R. 126, 130, C. C. A. 2; *Fisher* v. *Automobile*, 201 F. R. 543, 545, affirmed 209 F. R. 255, C. C. A. 2; *Albany* v. *Worthington*, 79 F. R. 966, 969, C. C. A. 2; *Westinghouse* v. *New York*, 139 F. R. 265, 267; *Enameled* v. *Western*, 269 F. R. 620, 628, 629, C. C. A. 6.) It attaches approximately one hundred and fifty words of interpretation to each claim of the patent affected and amounts *to changing the patent from a machine patent to a process patent.*

9. Thus the decisions of the two Circuit Courts of Appeals conflict upon several fundamental issues affecting the validity of the State patent, upon substantially the same record, and the divided decision of the Court of Appeals for the Third Circuit also raises a question of patent law of the highest importance to patentees in general, since it involves the question of the extent to which a Disclaimer can usurp the function of a Reissue by way of making alterations in a patent.

10. Petitioner believes and represents that the decision of the Circuit Court of Appeals for the Sixth Circuit, holding State's patent to be invalid, was right, just and correct in law, and that the contrary decision of the Circuit Court of Appeals for the Third Circuit in this case was erroneous.

Wherefore Petitioner respectfully prays:

That a Writ of Certiorari may issue out of and under the seal of this Honorable Court, directed to the United States Circuit Court of Appeals for the Third Circuit, commanding said Court to certify and send to this Court a full and complete transcript of the record of all of the proceedings in this cause, to the end that said cause may be reviewed and determined by this Court, as provided by law; and that the Petitioner may have such other and further relief as to this Court may seem appropriate and in conformity with law.

LIVINGSTON GIFFORD,
THOMAS G. HAIGHT,
E. CLARKSON SEWARD,
Counsel for Petitioner.

We hereby certify that we are of counsel for Petitioner herein, The John E. Thropp's Sons Company; that in accordance with the request of said Petitioner the foregoing Petition has been prepared; and that the allegations contained in said Petition are true, to the best of our knowledge and belief; and that said Petition is, in our opinion, well founded in law and in fact, and should be granted.

LIVINGSTON GIFFORD,
THOMAS G. HAIGHT,
E. CLARKSON SEWARD.

SUPREME COURT OF THE UNITED STATES,

OCTOBER TERM, 1922.

NO.

THE JOHN E. THROPP'S SONS' COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

BRIEF IN SUPPORT OF PETITION.

Grounds for the Application for Writ of Certiorari.

The grounds upon which the Writ of Certiorari is asked are briefly as follows:

1. The decision of the Circuit Court of Appeals for the Third Circuit, here sought to be reviewed, is in conflict with a previous decision of the Circuit Court of Appeals for the Sixth Circuit, in the case of *Frank A. Seiberling* v. *Firestone Tire & Rubber Co.,* December 13th, 1918, holding the State patent here in suit invalid (257 F. R. 74).

The issues upon which the case was decided in the Third Circuit in favor of the patent, were, on full hearing, decided in the Sixth Circuit adversely to the patent. In each case, the full state of the art was presented, and in each case the Courts have directly disagreed on the substantial issues. The patent is, therefore, valid in the Third Circuit

and invalid in the Sixth Circuit. This situation should be corrected, particularly since the case is of great importance affecting the manufacturers of automobile tires in general throughout the United States, and the conflict of decision gives rise to a condition of great confusion in the various Circuits.

2. Of the seven Judges of the different Courts to whom the question of the validity of the State patent has been presented on the full record, *five* disagree with the conclusion of the *two* Judges constituting the majority of the Court of Appeals for the Third Circuit in the case at bar.

3. In the present case, the respondent has filed a Disclaimer, which attempts to rewrite eleven of the claims, so as to make them be, in effect, method or process claims, instead of machine or apparatus claims, as they originally were. This Disclaimer seeks to add to each of said eleven claims about *one hundred and fifty words of interpretation*, and is a document the like of which has never been approved by any Court prior to this decision of the Court of Appeals of the Third Circuit. It is of the utmost importance to all persons or concerns interested or connected with patent matters that it should be decided by this Court whether or not a Disclaimer, filed *ex parte* and not subject to examination by the Patent Office officials, can be used so as to change a machine patent into a method patent. If this point is not now decided by this Court, there will undoubtedly be numerous attempts along this same line which will result in a great amount of litigation and indecision as to a fundamentally important provision of the patent Statutes.

Argument.

The State patent in suit, the prior hand operation of making tires, and the Belgian patent, are briefly described in Appendix C (pp. 48-52).

As set forth in the foregoing pages, the contentions of the parties and the records in the two cases in the Sixth and Third Circuits were substantially the same, so that there is a fundamental difference of opinion between these two Courts. While the Disclaimer was not filed until after the decision in the Sixth Circuit, and while the question of its legality is one of great importance, it does not change in any respect the main issues upon which the two Courts of Appeals have disagreed. This is so because the Court of Appeals in the Sixth Circuit, apparently in order to make its decision a most comprehensive one, took full note of Respondent's argument that the State patent really covered a new *method* or *mode of operation* and, after full consideration, held that the said method or mode of operation was *not*, in fact, *novel*. Thus the filing of the Disclaimer injected nothing new into the case, except the legality of the Disclaimer itself, for the reason that the method or mode of operation which it seeks to write into the patent is the same as that which was argued to and fully considered by the Court of Appeals in the Sixth Circuit. The decision in the Sixth Circuit did not hold the patent invalid because the form of the patent specification or claims was faulty, but because there was neither novelty nor invention in the thing described and claimed, nor in the method or mode of operation attributed to the patent by Respondent. Therefore, no amount of correction by Dis-

claimer could obviate the difficulty. Indeed, it may fairly be said that the said Court considered the claims here involved as if the Disclaimer had at that time been filed. As shown by the foregoing extracts from its opinion, the Court of Appeals in the Sixth Circuit expressly considered the questions of "centrifugal force" and "high speed rotation of the core" as well as the alleged "method" or "mode of operation" in general. We emphasize this point because the majority opinion of the Court of Appeals for the Third Circuit says (Rec. Vol. I, p. 637) "in our view the record presented in this case is substantially different from that before the Circuit Court of Appeals" of the Sixth Circuit. In point of fact the record before the Court of Appeals in the Sixth Circuit was *not presented* to the Court of Appeals in the Third Circuit, so that there was no opportunity for comparison of the two records by the latter Court and, therefore, the above quoted expression must be considered in the light of this fact.* We would also point out that the Opinion in the Third Circuit does not state in what particulars the records in the two cases differ, but, on the other hand the main ground upon which majority Opinion in the Third Circuit sustained the validity of the patent (*i. e.*, the effect of centrifugal force) was expressly considered and overruled by the Court of Appeals in the Sixth Circuit. Moreover, on the questions of aggregation, of the effect of the Belgian patent, of the Seiberling and Stevens patent and of the prior hand method, the majority opinion of the Court of Appeals in the Third Circuit takes direct issue with

* In *Diamond* v. *Consolidated*, 220 U. S. 428, Certiorari was granted although the second Court of Appeals said (151 F. R. 239): "In view of this *new aspect* of the case, we have no reason to doubt that on the *present* record" the first Court of Appeals would reverse its prior decision.

the arguments advanced and the conclusions reached in the Opinion of Judge Denison expressing the unanimous view of the Court of Appeals in the Sixth Circuit.

In the Opinion expressing the decision of the majority of the Court of Appeals for the Third Circuit, it is held that the *dominating* feature of the invention of the patent in suit consists in rotating the core at such high speed that centrifugal force, generated thereby, acts upon the outflying edges of the fabric to automatically stretch the same radially and contract them circumferentially. This feature is frequently referred to in the opinion as, for instance, Rec. Vol. I, p. 644, where it is said:

> "But here he [State] changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel [core] and flying skirt of the uncemented loose fabric *stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric.*"

and on page 643 of Vol. I of the Record, the Court said:

> "the *crux and dominating* functional feature of State's machine is the *use upon the fabric of a centrifugal force caused by rapid rotation,* a process which is wholly different from the original hand process,"

and again the same page:

> "there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the *consequent exercise of centrifugal force on the covering material, by which it is automatically gradually stretched radially*"

and on page 649:

> "we are satisfied that the *utilization of centrifugal force to stretch the fabric* and the action

> of the *spinning rolls upon a centrifugally, automatically stretched fabric*, was an entirely new combination which State brought into the tire art."

and on page 651:

> "State, on the other hand, left the skirts of his fabric free, and *stretched those fabric edges into radial diamond-shaped interstices, by the use of high-speed core rotation.*"

It should be noted at the outset that *there is not a word in the patent in suit about radial stretch being produced by anything, much less that it is produced by centrifugal force.* Indeed, centrifugal force is not mentioned as performing any function whatever. As said by the Court of Appeals for the Sixth Circuit (p. 43, *infra*):

> "centrifugal force is not mentioned, in State's specification, save as creating an obstacle to be avoided."

So that the Court of Appeals for the Third Circuit has based its contrary decision upon something which the patentee nowhere suggests. Again, there is no evidence in the record to support this basic holding and, as shown by the affidavits of Professors Kavanaugh, Pegram and Anderson (Rec. Vol. I, pp. 667-676), any centrifugal force generated by the high speed rotation of the core will act in a direction *opposite* to that attributed to it by Judge Buffington, and will *tend* to circumferentially (*not* radially) stretch the edges.

In this same connection, the Third Circuit Court finds that the spinning rolls merely act to apply or cement to the sides of the core the fabric which is said to have been automatically radially stretched by centrifugal force. Thus, it is said in

the opinion, Vol. I, page 644, after describing the radial stretch of the fabric skirts or edges by centrifugal force:

> "as the [spinning] rolls revolved they engaged and pushed inward and against the sides of the core the *stretched* flying skirts of the fabric. Thereby he [State] then, and by the wheels [spinning rolls], pressed and cemented the *radially stretched* and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge."

And again on the same page, it is said that the springs caused the spinning rolls

> "to automatically press the *automatically stretched and loose fabric,* or skirts, in an unwrinkled state, on the bead of the lower surface of the core."

On page 648, in describing the combination of the patent in suit, the opinion says:

> "the gist of which is *the rapid rotation of the core and its resultant radial stretch* acted upon by the self-adjusting, spinning rolls."

and again on page 649:

> "As soon as rapid rotation begins, roll spinning also begins and *utilizes the rapid rotation* to enable the rolls to plaster an unpuckered, *radially distended diamond shaped fabric* upon the core."

On page 651, it is said that State

> "never formed puckers, and indeed prevented their formation by radial stretch and radial diamond pointed interstices."

As already indicated, the centrifugal force cannot possibly produce radial stretch so that, in so far as any radial stretch is produced in the act of

smoothing the side edges or skirts of fabric down on the sides of the core, it is accomplished by the inward mechanical movement of the spinning rolls.

The fact that the fabric which the spinning rolls press against the core is *not* one which has been automatically radially stretched so as to eliminate the formation of puckers is fully shown by Plaintiff's Exhibit 35, photographs of State machines, which are reproduced on pages 189, 191 of Volume II of the Record. In these pictures, particularly on page 191, are shown an abundance of puckers in the unattached fabric, and it is admitted by Respondent's witness Trogner that this photograph shows a condition in which the spinning rolls have just about *completed* their inward radial movement on the outer layer of fabric (Rec. Vol. I, p. 626, Q. 28). This photograph shows not only the outer layer, but two or three inner layers, the spinning operations upon which have necessarily been completed, and which plainly embody a multitude of puckers or wrinkles. The operation of laying down the remainder of the puckered or wrinkled fabric *is performed by hand* (Rec. Vol. I, p. 234, line 30). This situation is well explained in the uncontradicted testimony of Petitioner's expert Waterman as to the operations of these machines which he witnessed at the Goodyear plant where the commercial machines were exhibited to him by Respondent's counsel and expert (Rec. Vol. I, p. 230, Q. 16). Mr. Waterman said, on page 233:

> "In practically every layer of fabric applied very large and very bad wrinkles were formed and it was necessary to stop the machine and lift up the fabric and smooth it down by hand with a spade, after having applied cement underneath in some instances."

When it is considered that this alleged effect of centrifugal force is the ground upon which the Court of Appeals for the Third Circuit has sustained the patent, and is the feature which it points out as distinguishing the method of operation of the patent in suit from the prior hand operation and the machine of the Mathern Belgian patent, and when it is noted, as previously recited, that the Court of Appeals for the Sixth Circuit has taken a contrary view as to centrifugal force and has expressly held that the hand method and the method of the Belgian patent are the same as the method attributed to the State patent, it will be clear how diametrically opposed are the holdings of these two Courts of Appeals, irrespective of the question of aggregation. This point of rearranging and reshaping the fabric meshes or reticulations by the action of centrifugal force permeates the opinion of the Court of Appeals for the Third Circuit and is given a place of major importance, while the Court of Appeals for the Sixth Circuit not only discounts this effect of centrifugal force but says, with respect to the rearrangement of the fabric meshes (p. 44):

> "This discovery by plaintiff or his counsel was in the realm of nomenclature, not of mechanics."

It may be stated that the Court of Appeals for the Sixth Circuit had the benefit of actually observing the operation of a full sized machine alleged to represent the patent in suit, of a full sized machine alleged to represent the Seiberling and Stevens patent, of a full sized machine alleged to represent the Belgian patent and of the hand operation, while, in the present case, the Respondent not only failed to operate its said alleged re-

production of the patent in suit before the Court, but repeatedly refused to operate the same in the presence of counsel and expert for Petitioner, even though formally requested on the Record so to do (Rec. Vol. I, p. 172; pp. 501-503).

In view of the fact that four Circuit Judges and one District Judge have already held the State patent invalid, as opposed to two Circuit Judges who have held to the contrary, it is presumed that this Court would not care to have, on this application, an extensive argument presented to demonstrate that the five Judges were right and the two Judges were wrong. However, a brief comparison of the State patent in suit and the Belgian patent, in connection with the prior hand method, is found in Appendix C (pp. 48-52), and that, together with the reasons advanced by Judge Denison, as set forth in the copy of his Opinion in Appendix A (pp. 31-44), especially when considered with what we have above said in respect to the main ground upon which the majority of the Court of Appeals for the Third Circuit based its decision, will demonstrate, we submit, that there is sufficient substance to our claim of invalidity to warrant the issuance of the Writ under the circumstances presented in this case.

Conclusion.

It is therefore submitted that the foregoing Petition for Writ of Certiorari should be granted.

Respectfully,

LIVINGSTON GIFFORD,
THOMAS G. HAIGHT,
E. CLARKSON SEWARD,
Counsel for Petitioner.

Appendix A.

Filed Dec 13 1918 Wm. C. Cochran, Clerk.

No. 2954

UNITED STATES CIRCUIT COURT OF APPEALS,

Sixth Circuit

The Firestone Tire & Rubber Company,
Defendant and Appellant,

vs.

Frank A. Seiberling,
Plaintiff and Appellee.

Argued March 14, 1917.
Reargued April 8, 1918.
Decided December 13, 1918.

Before Warrington, Knappen and Denison, Circuit Judges.

Denison, Circuit Judge: Seiberling brought the usual infringement suit against the appellant, based upon two patents, each relating to the manufacture of casings for automobile tires. The first was issued to Seiberling and Stevens on June 14, 1904, and was No. 762,561; the second was issued to Seiberling on November 30, 1909, No. 941,962, upon an application made by State. The court below held valid and infringed claims 1, 2 and 14 of

the earlier patent, and 16 claims of the later patent. The defendant had denied that there was either validity or infringement. After the case had been argued in this court, the defendant discovered a Belgian patent (Mathern, of September 20, 1906) said to show anticipation of State as to some features involved; and, upon an application to remand the case for further proofs, a stipulation was finally made and approved by the court by which this patent and explanatory affidavits were incorporated into the record. The case was then again argued. The record and proofs are unusually voluminous, but, in view of the conclusions which we reach, a relatively brief statement will be sufficient.

A tire casing of the class now involved is composed of successive layers of fabric, cemented together by a suitable composition and shaped into the form of a tube, which is open on one side so that it is horseshoe-like in cross-section, and the ends of which are joined together to make it circular and endless. The tube opening or slot is along the inside; and a solid rubber body is added along the outer circumference or periphery to constitute the tread portion of the finished casing. The general process of manufacture by hand, much older than the Seiberling and Stevens patent, was this: An annular metallic core having spokes and a hub was centrally mounted upon a shaft so that it could revolve, the core thus resembling the rim or tire of a wheel. This core was approximately circular in cross-section, and its cross-section diameter as well as its entire diameter through the hub from edge to edge of the rim were proportioned according to the size of the casing to be made. The operator coated this core with an adhesive substance. He then took a strip of rubber-impregnated

fabric which would stretch out to be as long as the circumference of the core, and in width somewhat less than the circumference of the cross-section. As he revolved the core on its hub, he stretched and pasted this fabric strip upon the core, pressing and shaping it with his fingers or with hand tools so that it adhered in all places and was without wrinkles. He repeated this operation as many times as there were to be fabric layers in the casing. The impregnating composition, having the character of rubber, would also attach each two layers of the fabric together. The strip of fabric was cut upon the bias, and the warp threads therefore ran from the inner open edge of the tube in a diagonal course along, across and around the tube to the other open edge thereof; and the next layer of fabric put on was reversed so that these warp threads crossed those of the first layer at a selected angle. Where the ends of the fabric met each other, they were overlapped enough to make a pasted joint. Each layer of fabric was first pressed down and attached by the hand of the operator on its central portion throughout its length, thus constituting the part of the casing corresponding to the tread. The degree of lateral curvature here is slight, and there would be no difficulty in making a smooth attachment, but as it was continued around the remaining circumference of the cross-section, there would be an obvious tendency to gather and wrinkle. This wrinkling would be fatal to the strength of the casing, and it could be avoided only by careful manipulation and gradual shaping. The ultimately smooth and unwrinkled surface could be had by virtue of a quality which all woven material has had since weaving was known, *i. e.*, that it will contract in one direction as it stretches in another. When a fabric

is stretched in one diagonal direction, its square meshes become diamond-shaped, with the length of the diamond along the line of stretch and its width at right-angles. This produces a contraction of the fabric in the line of its width. In tire building, it is primarily the central part of the strip which is thus stretched longitudinally as it is attached to the tread of the core, leaving the side portions or wings projecting and free. Upon the same principle, if these side portions are then stretched laterally, they will shrink longitudinally, and, if this stretching is done in progressive measure as the edges are approached, the longitudinal shrinking will be greatest at the edge. In this way, it results that the fabric may be shaped smoothly and without wrinkles to the entire side core surface.

The Seiberling and Stevens patent seems to disclose a machine for doing this work automatically, instead of manually. The machine comprised (so far as now necessary to mention): first, a main power driven shaft which would indirectly engage and drive the core and with such selective connections that the core could be revolved at low speed or at high speed, or entirely released, as desired; second, a reel carrying the rubber-impregnated fabric strip; third, a tension roller retarding the reel, and thus causing the central tread strip of the fabric to be given a continuing stretch after the free end is attached to the core; fourth, a pressure roller or cylinder concaved on its exterior to match the shape of the tread of the core, whereby the tread portion of the strip was pressed upon and attached to the core as the latter revolved; fifth, an arm carrying, at its end, a laterally spring-pressed finger—"the jigger finger," and which arm was intended to be reciprocated rapidly, radially of the core, in such a way that the finger traveled in and out radially, pressing against the side of the core as

the latter revolved, and which pressure finger therefore traveled a saw-tooth course between the edge of the stretched, central, tread portion of the fabric and its final outer edge, and corresponded in function to the human finger pressing the fabric down against the core and stretching it into shape; sixth, a further arm containing a further pressure wheel to be applied along the edge of the attached fabric, after it was attached, to press it into a crease, constituting "stitching." The described operation is consistent with the idea that the side pressure-attaching finger would follow immediately the tread pressure roller, so that with one revolution of the core the machine would attach the fabric, press down the tread and press in the sides, and so that all of these devices would be in operation at the same time on the same strip. After one complete revolution, the core was stopped and the fabric cut away from the reel strip. If the one revolution had not been sufficient, then, after the fabric was cut away and the loose end pasted down, as many more turns could be had as necessary,—apparently with all the attaching means at work together,—if desired. Based upon the disclosure thus generally described, the patentees claimed:

> 1. "The combination in a machine of the class specified of a tension device to simultaneously smooth and flatten strips of fabric, a revolvable core to receive said strips from said device, means to form said strips approximately longitudinally about said core and means to regulate the tension on said feeding device."
>
> 2. "A machine of the class specified consisting of revoluble means to support the article to be built while in the process of manufacture and means for creasing or stitching portions of said article on said revoluble means."
>
> 14. (The fourteenth claim does not differ from the second in any respect now material.)

The second and fourteenth claims must be held invalid for the same reasons pointed out with regard to claim 4 of the State patent, later discussed. The creasing rollers are hung on a swinging arm which happens to be attached to the frame of the machine. It might as well be fastened to the ceiling of the room. The pressure applied to the creasing rollers, which forces the fabric into the creases, is the pressure of the operator's hand. They are not at any time or to any extent operated by the mechanism which operates the other parts of the machine. They are "only used at intervals." There is no combination between these creasing rollers with their supporting arm and the other parts named in the claim. Their mutual relation is precisely that of the writing lead and the erasing rubber in the rubber-tipped pencil, where the only connecting link is the carrier. *Reckendorfer* v. *Faber*, 92 U. S. 347, 23 L. Ed. 719. It may further be observed that claim 2 is not limited to a machine handling flat strips of fabric, unless by the phrase "in a machine of the class specified." This phrase, as found in other claims,—*e. g.*, 3,—shows no intent to effect such limitation. If the claim covers devices which receive and treat strips of fabric prewoven to form,—as it seems to,—it is anticipated by Johnston, Jeffrey or Moore.

We do not thus dispose of claim one. We are not prepared to say that it is anticipated or that there is no combination between its elements when they are treated as the specification indicates. The tread-pressure roller automatically effects the revolution of the core. With it, the reel and the tension device may be in simultaneous operation. The side pressure fingers are reciprocated by tripping in a connection with the main driving mechanism, and may be operated simultaneously with the other just named parts,—at least, for part of their work.

It is not necessarily fatal to the theory of combination that continuing the work of the pressure fingers may be necessary after the tension device has exhausted its function. Without intending to pass upon all the questions involved, we prefer to assume the validity of this claim and look to see if there is infringement.

The defendant's device is particularly described hereafter. It is enough now to say that it has no tread-forming roller which operates simultaneously with and in advance of the side-forming means, and that it has discarded the jigger finger, operated by the driving power of the machine, and has substituted side-pressing means of different form and operation.

Whether defendant's instrumentalities are equivalent to those of the Seiberling and Stevens patent, under any scope which the state of the art permits to the phrase "means to form said strips longitudinally along said core," is a question which we find unnecessary to decide. Another reason sufficiently requires the conclusion that claim one is not infringed. Out of the four elements named in the claim, the first is, "a tension device" which feeds fabric strips to the core, and the fourth is, "means to regulate the tension of said feeding device." In a certain sense, every tension device is, in itself, a means for regulating, and it is not impossible that, under some conditions, a tension device by itself might be held sufficiently responsive to the descriptive words of both the first and the fourth elements; but this claim must be construed to require the independent existence of the fourth element. This is the apparent force of the face of the claim. The specification carefully describes regulating means by which the tension resistance can be instantly varied at the pleasure of the opera-

tor, by turning an adjusting screw. The present first claim is a substitute for the first three claims as filed. At the time of filing, claims 1 and 3 contained no reference either to tension device or regulating means, while claim 2 did not mention a tension device separately from its included "means to adjust the tension on the feeding means." After a rejection, claim 3 was amended by inserting a reference to the tension device itself. After a further rejection, the three claims were cancelled and the present one substituted. It was then allowed. The applicant had presented one claim referring independently to the tension device and one claim referring independently to the means for adjusting the tension. With this in his mind, he withdrew them and presented and secured a claim calling for each of these elements as separately existing. The intent to regard the ability to modify the tension device as an essential part of the invention which was being patented, could not well be clearer. It seems now to have developed that this adjustability is not very important, in the commercial use of the machine; but these patentees then might well have believed that it was vital to an operative machine. They had in their minds a friction tension, and they saw that the amount of stretch to be given to the fabric by it would depend upon the length of the fabric strip under stretch, the width of the strip, the strength and other inherent qualities of the fabric, the extent and moisture contents of the rubber impregnation and very likely the temperature and humidity of the air in the factory. All these conditions might change from hour to hour. Hence, the independent and separate call for regulating means can not be considered a mere inadvertence, the limiting effect of which a court would be inclined to escape, if

possible. Although it may be voluntary and unnecessary, it must be given effect. (*McLain* v. *Ortmayer,* 141 U. S. 419, 425; *Arnold-Creager Co.* v. *Barkwill Co.*—C. C. A. 6—246 Fed. 441, 444.)

Defendant uses a different tension device. There is no efficient frictional resistance to the travel of the fabric to the machine, but the resistance is caused by a positive gear connection. The periphery of the fabric feed roller is compelled to travel at a speed proportionate to the peripheral speed of the core, and at a fixed percentage less. This percentage is determined when the machine is built, by providing, for the feed roller and for an intermediate roller peripherally driven by the core, intermeshing gears of the same number of teeth, and by making the feed roller of smaller diameter than the intermediate roller. After the amount of stretch is thus determined and fixed,—at, say, fourteen per cent.,—it can never be varied,—unless by an expedient which plaintiff suggests and upon which theory alone he seems finally to rely to make out infringement of this claim. It is said that, by substituting upon the feed roller another gear with a greater or less number of teeth the speed of the feed roller can be increased or diminished. This is true; and it may well be that if the defendant's machine were built in contemplation of such a change, and if an assortment of gears were provided with it therefor, it should be thought to contain "means to regulate the tension"; but there is nothing to indicate that the machine was built with any such purpose, or that the defendant has any means of thus regulating the tension, or ever has done so or desired to do so. In this situation, it seems an apt suggestion by defendant's counsel that we might as well say an ordinary table con-

tains "means for regulating" its height, because we can take off the legs and put on some longer ones.

The theory that the constant stretch insured by defendant's mechanism constitutes both a tension device and a means for regulating it is urged by plaintiff's counsel, when they say that "to regulate" means "to maintain." To adopt this theory is to say that the phrase "means to regulate, etc.," adds nothing to the claim. We can not conceive any tension device which is not, in itself, "means to maintain" a fixed tension. Further, the theory would be, obviously, untenable, unless the patent were entitled to the most extreme liberality because it produced very great practical commercial results. It can not have such a degree of credit. If the machine in the patented form had proved successful, and had gone into extensive or even considerable use, it might be regarded in this light, even though it had not been generally accepted until aided by later patented improvements. This did not happen. One machine was built, but there is evidence that no tires were successfully made upon it, and that the jigger fingers would not smooth the sides so as to make first-class tires. Certainly, its attempted use by the Goodyear Company was abandoned, the machine discarded, and no other ever built.

We further find that upon the application for the State patent Mr. Seiberling, familiar with everything which had been done on the Seiberling and Stevens machine, made an affidavit that State's machine "was the first to successfully make such tires on a commercial scale by machinery." This affidavit does not work any estoppel, but there is every reason why we should accept it as true in its necessarily implied reference to the Seiberling and Stevens machine, and decline to give that pat-

ent the breadth of construction, beyond its letter, which is appropriate only for a great practical success.

Whether defendant employs any tension device "to simultaneously smooth and flatten strips of fabric," interposing, as it does, nothing between the feed roll and the means which throw the fabric out of flat, may be passed without consideration. For the reasons stated, it must be held that there is no infringement of claim 1.

The Seiberling and Stevens patent belonged to, or was practically under the control of, the Goodyear Company, one of the largest manufacturers of tires, and of which Mr. Seiberling was general manager. State was in the employment of the same company. After about five years, State filed his application for the second patent in suit. His machine was developed and his patent application prosecuted under the supervision of Mr. Seiberling. *State's machine was of the same general type as Seiberling and Stevens.* His most substantial change or improvement was that he discarded the reciprocal in-and-out forming-finger of Seiberling and Stevens and substituted a tool which he rightly calls a spinning roll. He provides, in the same general way, a core and a fabric reel and a retarding device, whereby he gets his strip of fabric attached to the core for the width of the tread portion, leaving the remaining wing portions projecting outwardly. Attached to the base of the frame which carried the revolving core was a standard, manually adjustable horizontally to and from the core; that is to say, it traveled in a horizontal track, which track was an integral part of the frame. At the upper end of this standard was a revolving head or table, called, by State, a turret, and so plainly the turret of the common turret

lathe that his choice of name was most natural. Mounted at four equi-distant points on the edge of this table are four tools, independent of each other except for their common base. The first carries the tread roller, the second the spinning rolls, the third the stitching rolls, and the fourth the bead attaching rolls. The turret standard was fixed in the plane of the revolving core, beyond the periphery thereof, and State revolved his turret until the tread roller was in the same plane, with its axis at right-angles thereto. He then moved the standard and turret forward so that the tread roller bore against the tread on the core, with such pressure as the operator chose to give it. When the tread was sufficiently smoothed down and attached, he moved the standard back, gave the turret a one-fourth revolution, bringing the spinning roll device to bear and moved that forward in the plane of the core until the operation of spinning down the side was complete. He then withdrew the standard, gave the turret another one-fourth revolution, and, in the same way, moved it forward again and used his creasing or stitching roll, if necessary. Then, again, by a similar operation, he brought into effect the fourth device on his turret, which was a bead-forming or trimming roll, to be used in certain cases only. In each instance, the time during which and the pressure with which the tool was to be applied (except for certain spring pressure) was regulated by the operator's hand. In no instance did the machine do anything except to keep the core revolving. The fact that the tools were mounted on a revolving table, which table was mounted on the frame of the machine, cannot be important. From the standpoint of an interdependent combination, the situation is the same as if these four tools had been

lying upon a work-bench by the side of the operator and he had successively selected the ones he desired. While this is obvious, it is emphasized by the fact, clearly appearing, that operators using the State machine often discard the spinning tool mounted on the turret, and, after the tread is formed, spin the sides down by hand.

In the form of spinning tool shown in the patent, there are two rolls pressed toward each other by springs and operating upon both sides of the tire at the same time. There is, thus, an automatic feature to the pressure with which the spinning rolls are applied; but this does not show the existence of any combination with the remainder of the machine. A hand tool with two oppositely spring-pressed rolls would work in the same way if it were hung from any support, or held only by the workman; and there is no relation of dependency between the automatic action of the springs and the automatic action of the revolving core. They both affect the material at the same time, and that is the most that can be said. The fabric reel and the tension device have finished their function when the first revolution is completed and when the strip of fabric has passed once around the core and has been cut and the pasted-on joint made. They have no further office in the building of the tire than if they did not exist. The tread-forming roller then is brought into play and finishes its function and drops out of action. Then, and only then, the operator brings the spinning roll to bear. It performs its work precisely as it would if the fabric strip had been stretched and attached wholly by hand; and the sides of the tire, the tread of which has been formed by the aid of the machine, may be spun down and attached by hand operation just as they are by State's device.

We do not intend to deny that a true combination may sometimes be found where the same underlying mechanism operates all parts of the machine and where different elements separately act in successive steps upon the raw material as it is being transformed into the ultimate product (though the latest decision of the Supreme Court,—*Grinnell Co.* v. *Johnson Co.*, 247 U. S. 426, perhaps tends to the contrary); but the trouble here is more vital. State's spinning tool has no operating connection whatever with the remainder of the mechanism. Each part performs its own work in its own way, and no new result flows from bringing the two into juxtaposition. We may find further illustration in the familiar turning lathe. If the cutting tool is carried in a holder which automatically travels along a line parallel to the axis of the revolving chucks which hold the material being shaped, we can see the combination between the chucks and the cutting tool; but not so, if the tool-holder is moved along its path by the operator's hand,—even though the path be upon a fixed guide.

In *Gas Co.* v. *United Co.*, 228 Fed. 684, we considered the distinctions between aggregation and combination. Applying to the present case the principles there developed and the authorities there cited, we are satisfied that there is no true combination between State's revolving core and his independent spinning tool, or between such core and his independent tread-forming roller, or between such roller and such spinning tool. The *Grinnell* case, *supra*, may involve the difference between that putting of old elements into a co-acting relationship which is invention as distinguished from a similar putting together which is merely skill, rather than involve the distinction between elements which form a composite as distinguished

from an aggregate; but, however that may be, that decision fortifies the result which we reach here. It is not easy to see any difference in principle between a device which first washes a garment, and then, by separate mechanism, dries it, and a device which first shapes and attaches the tread of the tire, and then, by separate mechanism, attaches the sides.

This conclusion invalidates, because of mere aggregation, claim 4[1] *and all the other claims of the State patent sued upon (except the fifteenth, seventeenth, and perhaps the eleventh).* We might safely rest our decision thereon; but plaintiff really presents his case on the theory that State discovered a new method of making tire casings or a new set of functions to be performed by associated mechanism. Although a mechanical patent may not be granted for a function (*Westinghouse* v. *Boyden Co.*, 170 U. S. 537), yet it is now settled that a method patent may be granted for an association of successive mechanical steps (*Expanded Metal Co.* v. *Bradford*, 214 U. S. 366), and to hold a mechanical patent void for aggregation, when the same monopoly sought by the patent might have been obtained through a method patent, seems somewhat artificial; hence, we prefer to point out also that State had nothing broadly new either in his method or in his selected tools; and that so far as some details may be new, they are not used by defendant.

The art of shaping a flexible sheet of metal down over irregular forms or dies, circular in cross-section,

[1]Claim 4. An open tire-shoe making machine, comprising the combination of a sheet-fabric supply, a power driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support, for passing radially along the sides of the tire-shoe, to shape the sheeted fabric on the core, substantially as described.

was very old and was known as "spinning". This was done by clamping the metal sheet upon the form, revolving both together rapidly upon the axis of the circular cross-section, and then with a tool,—which might be a narrow or sharp-edged roller or disc held in a yoked handle,—pressing the metal down against the form. The spinning disc, being held in a plane substantially tangential to the circumference of the form at the point of contact, would itself be caused to revolve; and, if it were slightly inclined inwardly from this tangential plane, it would gradually move down along the side of the form and its path thereon and upon the metal would be helical. The successive coils of this travel might be so close together that they practically touched each other, and so the whole surface of the sheet and of the form would be covered by this travel and the sheet would be stretched and shaped to the form. If State had been the first to observe that this spinning process could be applied to shape a tire upon its core as well as to shape a bottle cap upon its core, the question of whether there was invention in the transfer would have required consideration; but he was not. *The evidence that this identical spinning operation was performed upon tire casings by hand tools before State's invention is sufficiently satisfying to meet all the requirements of the situation.*

One witness testified that this spinning operation with a hand tool was common practice for smoothing down the sides of tires at a date three years earlier than the building of the first State machine; one told of the same practice in use at Detroit the same year State was constructing at Akron; and one seems to refer to it as a common practice in the Goodyear shop in 1903. Considered critically, all this testimony might not be sufficiently definite and

positive to prevail by itself against circumstances tending to throw doubt upon it; but there are no such circumstances. When defendant's proofs closed, this proposition would ordinarily be taken as fairly established; Messrs. State and Seiberling were called as witnesses on the rebuttal; both were familiar with the history of the art; neither one denied or questioned this proposition; nor did any other witness for plaintiff. More than this, State, in his specification, speaks of this spinning operation as if it were well-known hand practice, and seems to rely upon the advantages of his tool over the existing hand method. This is not all: The Seiberling and Stevens patent shows what it calls creasing or stitching rollers. Each one is undoubtedly an effective spinning tool and capable of use as such; their edges, as shown, may be sharp enough to cause some danger of cutting the fabric, but the spinning would be done by the side bevels, not by the extreme edge; and plaintiff's theory that defendant's spinning roll is so far the equivalent of the Seiberling and Stevens stitching rolls as to make out infringement of the claim based thereon goes far to persuade that they are, in a broad sense, an anticipation of State's spinning roll. There seems no sufficient reason to doubt that Stevens used them for spinning in 1903 or 1904. The Moore patent shows what is, essentially, a spinning roll for operating against a revolving core in making a tire casing. It was intended to and did smooth down the Moore tire from the center of the tread only part way, and not much further than may be done by the typical tread-forming roll; but the operation is substantially spinning, as far as it goes, and involves, in some degree, the characteristic relocation of the threads of the fabric, even though it may only put them back where they

were before the casing was distorted by placing it on the core. In the Moore patent, the handle of the spinning roll was so attached to its frame that the roller could not effectively travel radially of its core down as far as the bead, but if its attaching staple is made larger, the whole tire can be formed thereby, as demonstrated. Further, there is no reason to doubt that State and Seiberling were familiar with the character of patent protection, and were advised by competent counsel. If they had thought that State was the first to shape the sides of the tire by the spinning operation, it is highly improbable that he would have omitted to apply for a method patent. Still further,—it is conceded that the Belgian patent is a complete anticipation of State as to the matter of employing a radially-moving spinning roll in this type of tire-making machine for shaping the side of the tire,—unless plaintiff is right in his contention that in the Belgian patent the fabric was first partially attached to the side by a device resembling Seiberling and Stevens' jigger fingers, that this operation left wrinkles and puckers, and that the spinning roll was used only to remove these wrinkles and perfect the attachment. We do not see that this alleged distinction is very important. No matter if the fabric has been already partially attached,—as much as is consistent with any reasonable theory of operation,—the tool of the Belgian patent is a spinning roll, and performs a spinning operation; and, if we are right in what we subsequently say regarding the "centrifugal force" theory, *the Belgian tool in its radial progress was bound to stretch and reshape the fabric in substantially the same way that is done by State.* Putting all these things together, State can not be considered as the inventor

of the method; and hence there is no reason to hesitate at the result reached because of aggregation.

One group of State's claims is distinguished by the call for shifting the revolution of the core from a slow speed while the fabric strip is being put on to a high speed while the spinning is to be done. Seiberling and Stevens did the same thing, so far as concerns any broad idea, and the particular devices by which alone State distinguishes this part of his action from Seiberling and Stevens are not employed by defendant.

Another group of claims is characterized by the requirement that the spinning roller should be set in a plane at "a receding angle" to the plane of the core. It is not clear that this thought imparts any novelty to the claims. The same angle is shown by the Seiberling and Stevens stitching rollers, and it was certainly open to the user of any hand tool to apply it in this specified plane. However, the defendant does not do this; the claim of infringement in this is based upon a confusion of thought. If we picture the spinning roller as a disc,—whereby its plane is more sharply conceived,—and if we assume that the core is vertical and its axis horizontal, and that the disc is to be applied to the core midway from top to bottom, we observe that the plane of the core and the vertical plane of the axis are at right-angles to each other, and that the relationship of the plane of the spinning roll to the plane of the core, and its relationship to the plane of the axis, are independent of each other. The plane of the spinning roll may be at right-angles to the plane of the core and at the same time at any selected angle to the plane of the axis. So far as concerns the first relationship above stated, defendant's spinning roll is normally set with its axis horizontal and parallel with the core plane, and therefore

operates in a plane at right-angles to the plane of the core; but it is capable of adjustment to, and is intended sometimes to operate in, a plane not at a receding angle to the plane of the core, but at an angle which, as compared with that shown by State, is more than ninety degrees,—an advancing angle. In other words, its carrying yoke, normally at a right-angle to the core plane, may be swung slightly on its pivot toward the outside of the core. The only purpose and utility indicated by State for his receding angle are that the disc may not become entangled with the out-flying skirts of the fabric, and the angles adopted by defendant, for normal use or for special setting, tend to produce the very result shunned by State. In the machines used by defendant the spinning roll may be manually placed at the "receding angle," but in operation it will not stay there, but returns at once to the right-angle position. Defendant did at one time make some use of a machine embodying this "receding angle," but it was not practically more than experimental and has been abandoned, and was too negligible to justify any judicial action based thereon. The defendant does set its disc at an angle, which may be called "receding," to the vertical plane of the core axis; the disc axis (in the form assumed) ceases to be horizontal, being shifted perhaps ten degrees; but this is a different matter. This setting is for a purpose different, and causes a result different from anything found in State. It brings a constant radial slip or wipe of the roller upon the fabric, and directly causes a radial stretch. The claims of this group are not infringed.

If the "forming roll" of claim 11 is the spinning roll, the claim is invalid for aggregation; if this "forming roll" is the tread roller, then the claim

is anticipated by the Seiberling and Stevens machine.

Claim 15 suggests nothing new over Seiberling and Stevens, excepting a yieldingly mounted take-up roll for receiving a layer of muslin, or thin cloth, which is upon one face of the rubber-impregnated fabric as it is rolled upon the supply reel. Precisely the same take-up roll is shown in older machines for feeding similar rubber-impregnated fabric to make rubber belting. It can not be important that the fabric in this case is received by a revolving core, rather than by the receiving mechanism of the old machines. The take-up roll does its old work in its old position and for its old purpose. Its transfer from the old machines to Seiberling and Stevens discloses no inventive novelty. Claim 17 also reads upon Seiberling and Stevens, save for the addition of "a stretching roller between the tension device and ring core whereby the longitudinal creases are taken out of the fabric and it is smothly and evenly supplied to the ring core." This also discloses the adoption of a device in common use for the same purpose in analogous situations; but its declared purpose and effect are to avoid the very operation which defendant employs. This stretching roller is for the purpose of delivering the fabric to and upon the ring core in a smooth and flat state. Defendant interposes a convex shoe which delivers the fabric strip to the core in a curved or U shape. The curved shoe or form which gets the latter result could not be considered the equivalent of the flat rollers which get the former without a much greater degree of liberality than is,—at the best,—permitted by the state of the art.

Claim 14 is not sufficiently typical to justify using it as the criterion of infringement, as plain-

tiff would have us do; but, if it were, it shows still another reason why plaintiff must fail. It calls for a stock roll, a ring core, "a radially and transversely movable support, a tread forming roll and a laterally yielding spinning roll for passing radially over the sides of the tire shoe mounted thereon," etc. The tire shoe is not mounted on the spinning roll; the clause "for passing * * * tire shoe" is parenthetically descriptive, and the claim must be considered as specifying a radially and transversely movable support having mounted thereon a tread roll and a spinning roll. Defendant has no one support carrying these two rolls, but has two independent supports. One is movable radially, neither transversely. The claim plainly refers to the revolving turret, when it says "support," and defendant has nothing equivalent.

The argument for plaintiff takes the Seiberling and Stevens invention of 1903 and the State improvements of 1908 and puts them together as constituting one pioneer patent dated in 1903; or, stated in another way, it takes the large public acceptance and use of the State patent and thereby attributes merit to the Seiberling and Stevens patent, overlooking the undoubted fact that the first reasonably successful commercial machine was that of Vincent, who intervened between the two. It goes without saying, that the Seiberling and Stevens patent is just as effective in denying to State the position of pioneer as if it had not happened that both have been controlled by the same interests.

We are told that the centrifugal force disclosed by State's operation caused the unattached skirts of the fabric to fly out at right-angles to the plane of the core, and that the effect of the spinning tool slowly advancing against this skirt was to produce

a "hinging and folding action" which was novel and important. We are not impressed by this claim. These words do not seem very appropriately descriptive, but the action which takes place not only pertains to a method or process rather than to any particular mechanism, but it was more or less inherent in the rapid revolution of the core effected by older means, and in the use of any spinning, stitching or creasing rollers. It is not the "hinging and folding" but the radial stretching, and the resulting circumferential contraction, that bring about the desired smoothness. It is possible that in State's particular form of device, with his spinning disc at its "receding angle," and practically tangential to the core circumference at the point of contact, there will be enough "hinging and folding" back over his tool to produce a friction which would cause more stretch than could the mere rolling advance of the disc in its helical path; but if there is an appreciable effect of this kind, defendant does not have it. Defendant gets its stretch from the slip or wipe which is compelled by the fact that the spinning disc can not roll unobstructedly in its own plane,—which fact results from its inclination toward the plane of the core axis. This very inclination puts part of the disc out beyond the supposed line of "hinging and folding," and prevents a fold at the point of contact. *Centrifugal force is not mentioned, in State's specification, save as creating an obstacle to be avoided.* Perfectly successful spinning performed in court, upon a slowly revolving core, demonstrates that the outflying skirts are not essential. *To make centrifugal force an effective basis of validity in the State's patent would be to give a monopoly of the spinning process or of rapid core rotation; and each was old.*

We are also told,—and upon this plaintiff seems to place great reliance,—that Seiberling and Stevens or State,—we are not sure which, but apparently by some kind of joint action,—discovered and accomplished for the first time such a distortion of the fabric meshes as gave great strength to the built-up casing. This result plaintiff's counsel denominates "the rearrangement of the reticulations" and "placing the threads in geodetic lines." There was nothing new about this. On the contrary, it had been present in every smooth fabric tire casing that had ever been made by anybody. As we pointed out in the early part of this opinion, it is inherent in shaping a fabric to an irregular surface. It consists in the fact that when the rectangular mesh is expanded on one diagonal axis it will contract upon the other. Outside of tire casings themselves, a familiar instance is the shaping of canvas to cover the hull of a canoe. Still more familiar is the handkerchief or the collar, unevenly ironed. This discovery by plaintiff or his counsel was in the realm of nomenclature, not of mechanics.

The decree must be reversed, and the record remanded with instructions to dismiss the bill.

Appendix B.

IN THE

UNITED STATES PATENT OFFICE.

DISCLAIMER

PERTAINING TO PATENT NO. 941,962.

TO THE HONORABLE COMMISSIONER OF PATENTS,
Washington, D. C.

I, FRANK A. SEIBERLING, a citizen of the United States, residing at Akron, in the County of Summit, and State of Ohio, hereby represent, in the matter of a certain improvement in Pneumatic Tire Shoe Manufacturing Machines for which Letters Patent of the United States No. 941,962 were granted to me as assignee of Will C. State, also of said Akron, Ohio, on the 30th day of November, 1909, that I am the owner of the entire interest in said patent by reason of the aforesaid grant thereof to me, and that I have reason to believe that through inadvertence, accident or mistake, and without fraudulent or deceptive intention, the specification and claim of said Letters Patent are in part too broad, including that of which said State was not the first inventor.

Now, therefore, I hereby enter disclaimer, as follows:

FIRST: In respect to each of claims 4, 5, 6 and 7, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that

part of the recited ring-core beyond the tread portion, *and unless* the ring-core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force, and the recited spinning-roll support is mechanically mounted to ensure its radial movement with a gradual advance in proper relation to the fast rotating ring-core, whereby the spinning-roll, by such gradual advance over the ring-core and while pressed toward it, acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

SECOND: In respect to each of claims 12 and 13 of said patent, I hereby disclaim any combination of the recited elements, *except for* the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core and thereafter shaping and applying to the ring-core the fabric beyond the tread portion, *and unless* the recited elements are so contsructed and co-ordinated that before the change from slow speed to fast speed the fabric strip as drawn from the recited stock roll onto the ring-core is stretched circumferentially under uniform tension while applying it to the tread portion, and, after the change to fast speed, the unapplied fabric beyond the tread portion is thrown out from the side of the ring-core by the consequent centrifugal force, while the recited spinning-roll, in its radial movement, acts gradually upon the centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core beyond the tread portion while bringing it into adhesive contact therewith.

THIRD: In respect to each of claims 22, 23, 24, 25 and 26, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and co-ordinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll, in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

FOURTH: I hereby further disclaim that part of the claim of invention in said patent contained in claims 8, 9, 10, 11, 14, 15, 16 and 17, respectively.

FIFTH: In respect to the specification of said patent, I hereby disclaim at page 1, lines 79-80, the words "and an important feature of my invention", and at page 1, lines 92-93, the words "as another feature of my invention".

SIGNED at New York in the County of New York and State of New York, this 13th day of February, 1919.

FRANK A. SEIBERLING.

Witnesses:

R. F. ROGERS.

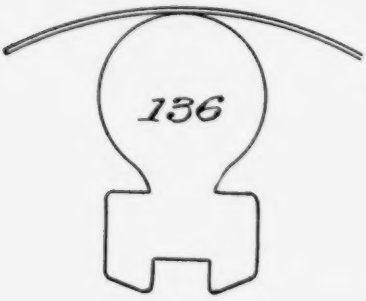
ARTHUR S. BROWNE.

Appendix C.

The State Patent in Suit.

This patent (Rec. Vol. II, p. 1) discloses a machine for making the fabric body portion of automobile tires. The machine includes an iron ring which is called a core, and is of the same size and shape as the interior of the tire to be made. There is also included a roll of fabric (canvas) which has been cut on the bias into strips and impregnated with a rubber compound. The iron ring or core is geared to a source of power so that it can be rotated at low and high speeds (in commercial operation about 8 RPM and 120 RPM). A strip of the rubberized fabric is applied circumferentially around the iron core by slowly rotating the latter so as to draw the fabric from its roll. The adhesive nature of the rubber causes the fabric to stick to the periphery of the core and, after it has been applied once around the core, the applied portion is severed from that remaining on the fabric roll, and the ends of the applied portion lapped or spliced. The condition of the fabric at this stage is indicated by Fig. 12 of the patent, which is here reproduced and in-

Fig. 12.



tended to represent a section of the core 136 with a layer of fabric applied to the periphery thereof.

Without referring to some intermediate operations which it is not necesary to consider at the present time, it may be stated that the side edges of the fabric strip need to be applied smoothly to the sides of the core. This is done by means of two so-called spinning rolls, which are metallic discs a few inches in diameter that are mounted on arms, which arms are carried by a support that is mounted to be fed by a screw radially inwardly toward the axis of the core. Springs or manual pressure are used to press the spinning rolls laterally against the fabric edges and stick them to the sides of the core, as the said spinning rolls are moved inwardly toward the axis of the core. This operation is indicated by Figs. 12*b* and 12*c* here reproduced.

Fig. 12b.

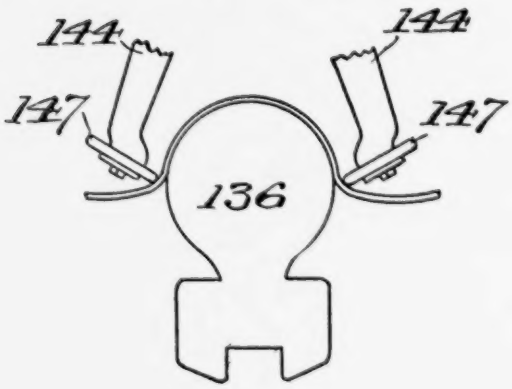
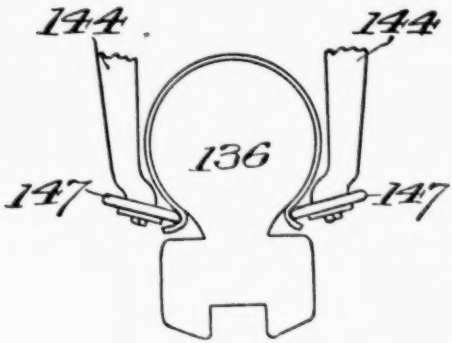


Fig. 12c.



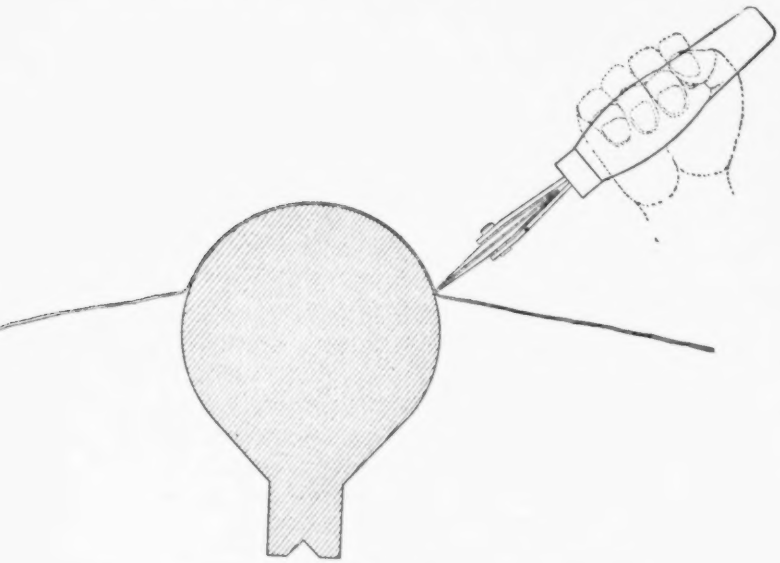
In these figures the core is again represented by 136, the spinning rolls are marked 147, and the arms which carry them 144. The progressive operation is shown by these two figures.

These spinning rolls are employed while the core is rotated at high speed, and it is believed that the inward radial movement of the spinning rolls 147, stretches the edges of the fabric in the same direction, so as to make the square meshes of the fabric take a diamond shape with the long axes of the diamonds radial of the core. This stretching is supposed to make the fabric fit smoothly to the curved sides of the core as the spinning rolls move inwardly.

Prior Hand Operation.

The prior hand operation was substantially the same. The core was rotatably mounted and the fabric applied circumferentially thereto by hand. The core was then rotated by hand until it gained

a high speed momentum and the side edges of the fabric were applied smoothly to the sides of the core by a hand tool similar to the spinning rolls employed in the machine. The following cut illustrates this last named operation.



This hand process was generally followed for several years prior to State's alleged invention, at numerous factories. It is abundantly proved by more than a dozen witnesses, including several of high standing.

Mathern Belgian Patent.

This patent (Rec. Vol. II, p. 217) is for a machine substantially like that shown in the State patent. It has the rotatably mounted core with means for rotating it at low and high speeds. There is a

fabric roll and means for applying the fabric strip circumferentially to the core. There is also a pair of spinning rolls or discs which are mounted on a support that is screw fed in a radial direction toward the axis of the core. Handles on the spinning wheel supports enable them to be pressed laterally against the fabric on the sides of the core to shape it and apply it thereto. There seems to be no denial that this machine contains all the instrumentalities of the State patent.

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1922

No. .

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

Notice of Submission.

TO ROBERT FLETCHER ROGERS, Esq.,
Counsel for Respondent.

Please take notice that on Monday, January 22, 1923, we shall submit the accompanying Petition for Writ of Certiorari to the Supreme Court of the United States, at the Capitol, Washington, D. C., at the opening of Court on that day, or as soon thereafter as counsel can be heard.

.....

.....

.....
Counsel for Petitioner.

Service of the above Notice of Submission, and receipt of five copies of the accompanying Petition for Writ of Certiorari and Brief in support thereof is acknowledged this day of December, 1922.

.....
Counsel for Respondent.

JAN 15 1924
WM. R. STANSBURY
CLERK

IN THE

UNITED STATES SUPREME COURT,

OCTOBER TERM, 1923.

No. 185.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner,

v.

FRANK A. SEIBERLING,
Respondent.

REPLY BRIEF FOR PETITIONER.

LIVINGSTON GIFFORD,
E. CLARKSON SEWARD,
THOMAS G. HAIGHT,
Counsel for Petitioner.

The Evening Post Job Printing Office, Inc., 184 Fulton St., New York, N. Y.

IN THE

United States Supreme Court.

OCTOBER TERM, 1923.

THE JOHN E. THROPP'S SONS COMPANY,
Petitioner-Defendant,

v.

FRANK A. SEIBERLING,
Respondent-Plaintiff.

No. 185.

REPLY BRIEF FOR PETITIONER.

Plaintiff's contention that the hand spinning method differs from the State machine method is (1) not supported by the record, (2) forms no part of his patent, and (3) is not in line with Judge Buffington's findings.

I.

Plaintiff devotes many pages in the effort to show that the hand spinning method was in the so-called "single stretch" class, but *he is unable to point out a single witness who said this.* Therefore, Plaintiff arbitrarily fixes the figure of 17 per cent. circumferential stretch as separating the single stretch class from the double stretch class (Opp. Brief, p. 13). He says that circumferential stretch of 17 per cent. or more indicates the single stretch method. On page 19, opposing brief cites the wit-

nesses Walch and Duncan in support of Plaintiff's contention that the hand spinning was in the single stretch class and, hence, had more than 17 per cent. circumferential stretch; but Plaintiff fails to note that Walch testified that the circumferential stretch in hand spinning was only *6 per cent.* (Vol. I, p. 291) and that Duncan said that *12 per cent.* was about as much as the ordinary hand worker would pull (Vol. I, p. 197). Thus, the two witnesses relied upon by Plaintiff put the hand spinning, by Plaintiff's own criterion, in the *double* stretch class. Furthermore, Duncan explains the changes in the angle of the fabric threads on the ..ead and side portions, which Plaintiff says is characteristic of the double stretch method, as being produced in the hand spinning (Vol. I, p. 198). Heller testified to *1¼ per cent.* stretch in hand spinning at the Diamond plant (Vol. I, p. 124), also within Plaintiff's definition of the double stretch method. Drach testified that he got more stretch by hand spinning than by Plaintiff's so-called "saw tooth" method, which Plaintiff says brings about the double stretch (Vol. I, p. 105). It should be emphasized that opposing brief, at the bottom of page 25 and top of page 26, says that Walch was unable to give or even estimate the amount of circumferential stretch, in spite of the fact that this witness accurately gave this as 6 per cent. (Vol. I, p. 291). At this place also, Plaintiff again quotes from Duncan without noting his statement that 12 per cent. was as much as the ordinary workman would pull (Vol. I, p. 197). As mentioned in our main brief (p. 102), the exhibit tires made by Plaintiff's witness Mackey, by the hand spinning process for the purpose of this case, show the radial stretch, and, therefore, demonstrate the presence

of the double stretch method. Opposing brief (pp. 71, 72) contends that the only radial stretch shown in these exhibits is in the bead portion which, it is said, Mackey did not spin down. But the evidence is that this spinning at the bead portion was done at the Goodyear plant by hand spinning (Vol. I, p. 234), and it is, of course, immaterial whether the spinning was done by Mackey or someone else.

II.

The State patent itself says absolutely nothing about single stretch or double stretch. It nowhere mentions circumferential stretch, although it refers to tension, and it nowhere refers to any radial stretch whatever. Plaintiff's expert admits this, saying (Vol. I, p. 513):

> "I do not recall any place in the State patent which refers to radial stretch."

It describes the tension means used in resisting the circumferential application of the fabric to the core as being regulatable at will (Pat. p. 2, line 121), and *there is nothing in the patent specification to tell the workman that he should adjust this so as to make the machine operate according to either the single or double stretch methods.* If the machine is adjustable for one method, it is equally adjustable for the other, and opposing brief (p. 11) says that both these methods were well known. Of course, it is the law, as asserted on page 104, *et seq.*, of opposing brief that it is not necessary for a patent to set forth the theory of its operation, provided the patent gives such definite instructions that any one following the instructions will get

the intended result. But this does not support Plaintiff's contention that the State patent is for the double stretch method, because the specification of that patent does not instruct one to follow the double stretch rather than the single stretch method and does not give any instruction which would necessarily result in the double stretch.

Finally, the State patent makes particular reference to a hand held spinning roll (Pat. p. 5, line 113), and merely says that the machine work is "more rapid and more even". *It does not suggest that there was any difference in the methods*, and its silence on this point implies the contrary. To the same effect is the testimony of State given in rebuttal, since he says that a man by the name of McDonald demonstrated to him the hand spinning method and that it constituted a part of the experiments carried on in producing his machine (Vol. I, p. 309). At the time of this testimony, all Defendant's evidence with respect to hand spinning had been taken, so that State was clearly called upon to differentiate this hand spinning method from his machine method, if there was any difference.

III.

This position of Plaintiff is not in line with the findings of Judge Buffington, because he said in his opinion below (Vol. II, p. 404), as quoted on page 92 of our main brief:

> "we note the fact that tires embodying these two features of *double* stretch and roll-*spinning* fastening were, before the patent to State here in question, *hand* made." (Italics ours.)

thus holding directly contrary to Plaintiff.

The distinction between the hand spinning method and the State machine method, found by the Court below was that, in the machine method, the core was rotated so rapidly that the *fabric automatically stretched itself radially*, so that all the spinning rolls had to do was to *plaster* the centrifugally radically stretched fabric edges upon the sides of the core. Numerous quotations from the opinion to this effect are given on pages 37 and 38 of our main brief. **Plaintiff's brief says not a word to support this position of the Court below,** thereby strongly corroborating our submission that this holding of Judge Buffington is groundless and that the three professors of mechanical engineering who made affidavits on Petition for Rehearing were right. Indeed, Plaintiff goes so far as to say, on page 92 of his brief:

> "Judge Buffington may or may not have ascribed too much power to that force;" [centrifugal force].

Plaintiff goes on to argue that it is the combination of the fabric edges thrown out by centifugal force and the inwardly moving spinning roll which produces the radial stretch. But in this argument *he runs foul of the prior hand spinning* because, as mentioned in our main brief (p. 90), the witnesses testified that, in the high speed rotation of the core used in hand spinning, the edges of the fabric were caused to stand straight out, and that the spinning roll was moved radially inwardly against the outstanding fabric. That this produced radial stretch has been shown by the evidence mentioned in Chapter I, *supra*.

Therefore, we have the condition where the record evidence clearly shows, and the *Court below finds*,

that the hand spinning made tires according to the double stretch method. While agreeing to this, Judge Buffington says that the machine process differs because its high speed rotation of the core generated *centrifugal force* which caused the fabric to *stretch itself* radially. This would be a distinction if it were a fact; but in this Judge Buffington was mistaken, as we have shown in our main brief, and as the three professors have stated in their affidavits. **Plaintiff knows that Judge Buffington was mistaken and cannot, therefore, support the Judge's position in his brief.** Therefore, Plaintiff is forced to revert to his old argument that the hand spinning did not have any radial stretch at all, which argument, as demonstrated, is not supported by the record and is overthrown by the findings of the Court below. We need only add that, as mentioned in our main brief (p. 88), the Court of Appeals for the Sixth Circuit held that the hand spinning was "identical" with the method of the State machine, and that Court had the benefit of seeing both operations performed. The same finding of fact was made by the District Court of New Jersey.

Double Stretch.

Plaintiff accentuates this subject so much that we must emphasize the following facts.

I.

Double stretch is no part of the State patent. It is neither the described nor the necessary operation of the machine described therein (see pp. 2, 3, *supra*).

II.

Double stretch is no part of Defendant's operation or the necessary result of Defendant's machine (see our main brief, pp. 147, 148, and this reply brief, *infra*).

III.

Double stretch was old in the hand spinning process (see pp. 1 and 2, *supra*).

IV.

Double stretch was old in the Belgian machine and the Seiberling and Stevens machine (see our main brief, pp. 32, 106, 107, 124, 127, 128, 129).

Specific Criticisms of Hand Spinning.

On page 27 of opposing brief, it is stated that Defendant's witnesses agree that the hand spinning was used "entirely" in the production of small tires and that the larger tires had to be made by a different method. This is inaccurate. Duncan testifies that hand spinning was used at the Hood plant from 1906 to 1918 on tires as large as five and one-half inches in cross section, which is a very large size (Vol. I, p. 203). Mell testifies that this same method was used at the Republic plant for years on tires as large as five inches (Vol. I, p. 155), and Walch gives testimony to the same effect as to the operations at the Ajax Company (Vol. I, p. 289).

On pages 30, 31 of opposing brief, it is said that high, uniform core speed is an "absolute requirement" to secure radial stretch. This is inaccurate. Even Plaintiff's expert would not assert it. He was asked whether, if the core were rotated at a very

low speed of only 6 to 12 revolutions per minute, there would be the rearrangement of the fabric cords referred to as radial stretch, and he said (Vol. I, p. 66):

> "I do not feel that I am at present qualified to answer this question. I have not investigated the effects of attempting to form the fabric with the core rotating at slow speed sufficiently to enable me to express a definite opinion with regard thereto."

The Court of Appeals for the Sixth Circuit said (see Appendix to our main brief, p. 23):

> "Perfectly successful spinning performed in Court upon a slowly revolving core, demonstrates that the outlying skirts are not essential."

Under the heading "Core Speed Too Slow in Hand Spinning", Plaintiff's brief endeavors to make it appear (pp. 33, 34) that the hand spinning speed was lower than the spinning speed used by Defendant. For this purpose, Plaintiff's brief takes the maximum hand spinning speed at 50 to 60 R. P. M. This is erroneous. On the contrary, we have shown in our main brief (pp. 99, 100) that there is no difference between the old hand spinning speed and Defendant's, which is between 120 and 130 R. P. M.

Moreover, it certainly can make no difference what the number of revolutions were per minute so long as the speed was fast enough to make the flaps stand out under centrifugal force, and we have shown at page 90 of our main brief the overwhelming and uncontradicted evidence that the flaps did stand out in hand spinning.

Plaintiff's expert Browne, did not say that 80 to 120 R. P. M. was the "minimum requirement", as

stated on page 34 of opposing brief. He stated that the fabric was thrown out to an appreciable extent at 50 R. P. M. on a medium size core (Vol. I, p. 64, x-Q. 84); and he refused to state within 45 degrees at what angle the fabric must be thrown out before, as he alleged, it usefully cooperated with the spinning rolls (Vol. I, p. 69).

On page 34 of opposing brief, the speed of 50 to 60 R. P. M. stated as given by Roe, had reference to that form of hand spinning in which the core was continuously rotated by one hand. It did not refer to that form in which the core was given a high speed rotation and allowed to run under its own momentum.

On page 38 of opposing brief, it is stated that hand spinning was finally abandoned altogether. This is an important inaccuracy. Only one witness referred to a change as being made, and that was at only one factory, and in the late year 1910. Furthermore, he says that the process was only changed on that part of the work *over the top* of the bead (Vol. I, p. 104). The evidence shows that this process was continued by the following concerns: Goodrich Company, Firestone Company, Republic Company, McGraw Company, Miller Company, Ajax Company, Empire Company, Batavia Company and Hood Company (Vol. I, pp. 136, 137, 138, 153, 154, 155, 169, 127, 286, 287, 294, 295).

State's Deposition.

This deposition of the alleged inventor of the patent in suit, to which Plaintiff devotes pages 44 to 56 of his brief, is entirely uncorroborated, although State testifies that there were four other men working with him at the time, so that corroboration should have been ready at hand. Under

the authorities, this testimony should, therefore, be accepted with the greatest caution, if not rejected as supporting Plaintiff's case. *Clark* v. *Williamantic*, 140 U. S. 486, 491; *Mergenthaler* v. *Scudder*, 11 App. D. C. 264; *Winslow* v. *Austin*, 14 App. D. C. 137; *Garrels* v. *Freeman*, 21 App. D. C. 207; *Kitchen* v. *Smith*, 39 App. D. C. 500.

The object of Plaintiff's brief in devoting so much space to the uncorroborated testimony of State seems to be to gain some advantage for the alleged invention here in controversy from the length of time that State took in arriving at his machine. It might be entitled to this importance if this Defendant were infringing the whole or any considerable number of the features of the State machine, but it loses all importance in view of the fact that there is no pretense that Defendant is infringing the State machine in general, and there is substantially nothing in State's testimony showing that any considerable experiment or effort was required in arriving at the particular features which Defendant is alleged to infringe.

State's story is that he started in June, 1907 (Vol. I, p. 336) and, within two or three months he had developed and built substantially the whole machine shown in his patent. By July or August he had completed the entire structure shown in sketch No. 11 (Vol. II, p. 89), and was producing good tires thereon (Vol. I, p. 362). There are 15 claims in the patent which Defendant is not charged with infringing, and there are obviously many mechanical details of the machine, not claimed, which took time for designing, selecting and building. A few months was certainly a very short time within which to build a machine of this character, without the necessity of making any important inventions whatever, and does not consti-

tute any proper ground for the argument Plaintiff makes that there was great difficulty in making any inventions embodied in it.

Much less is the time devoted to building this machine by State any evidence that any of the features which it is supposed to contain in common with Defendant's machine, were matters of difficulty. They might have been perfectly obvious to a man skilled in the art and yet the length of time in building the machine would have been nothing unusual.

Moreover, it does not appear that, while State was building this machine, he had the benefit of the knowledge of the prior art which is shown in this record. In fact, it appears that prior to building this machine, State's experience was confined practically to the Goodyear factory.

Plaintiff's Refusal to Operate His Reproduction of State's Patented Machine.

At the bottom of page 58, opposing brief excuses the refusal to demonstrate this machine to Defendant's counsel and expert on the ground that, at the time such demonstration was requested by Defendant's counsel, "the machine had already been dismantled and placed in the storage warehouse". Opposing counsel inadvertently overlooks the fact that such demonstration was first requested on the record very much earlier in the case (Vol. I, p. 172).

Commercial Success.

On page 64, opposing brief emphasizes an alleged error in our brief, by saying that the license agreements in the record do not mention the Seiberling

& Stevens patent, in addition to the patent in suit. This does not cover the case, because the license agreements printed in the record are supplemental agreements, which continue in force the original agreements at greatly reduced rates and under certain conditions, and Seiberling admits in his testimony that the licenses were granted and royalties paid under the broad Seiberling & Stevens patent in addition to the patent in suit (Vol. I, p. 404).

See also pages 10 to 12 and 43 to 44 of our main brief

Alleged Automatic Operation of State Machine.

An effort seems to pervade Plaintiff's brief to give the erroneous impression that State produced an automatic tire making machine. Nothing could be further from the fact, even if we consider only the so-called prior art hand spinning operation. In this old hand operation, State found the core exactly as he uses it. He found the hands being used to hold back on the fabric for giving the longitudinal stretch and he merely substituted a pair of ordinary rollers, instead of the hands, for performing exactly the same function. He found the spinning wheels held by the hands and he merely introduced a hand moved mechanical support to assist the operator in putting the old spinning wheels through their old motion for performing their old function. The opinion of the Sixth Court of Appeals stated the facts in regard to the State machine correctly (p. 12, Appendix of Defendant's brief) and concluded as follows:

> "In each instance, the time during which and the pressure with which the tool was to be applied (except for certain spring pressure) was regulated by the operator's hand. In no instance did the machine do anything except

> to keep the core revolving. The fact that the tools were mounted on a revolving table, which table was mounted on the frame of the machine, cannot be important. From the standpoint of an interdependent combination, the situation is the same as if these four tools had been lying upon a work-bench by the side of the operator and he had successively selected the ones he desired. While this is obvious, it is emphasized by the fact, clearly appearing, that operators using the State machine often discard the spinning tool mounted on the turret, and, after the tread is formed, spin the sides down by hand."

This subject has been quite fully covered in our main brief, but attention should be directed to the statement of opposing brief on page 90 that the spinning rolls are pressed to their work by springs that "exert a pre-regulated uniform pressure". This is repeated, in substance, at other places. This is quite inaccurate since, as Plaintiff's expert Browne admits, the pressure of the spring cannot be uniform, because it varies throughout the operation on any given core and for different sizes of cores (Vol. I, p. 63, x-Q. 78; p. 64, x-Q. 82).

Infringement.

On page 117, opposing brief says, "There is the admission by Defendant's expert that it [Defendant's machine] comprises mechanism for performing the double stretch method". This is erroneous. Defendant's expert maintained that Defendant's machine operated on the single stretch method only (Vol. I, p. 278, Q. 64). Plaintiff's assertion can only be accurate to the extent of saying that Defendant's expert admits that Defendant's machine comprises mechanism which *Plaintiff contends* would perform the double stretch method.

The illustrations bound in between pages 116 and 117 of opposing brief are quite inaccurate. The part colored in blue under the heading "State's Machine", *is not in the State patent,* nor is there any equivalent of it in the patent. It was incorporated later in commercial machines in order to give means for imparting *manual* lateral pressure to the yellow arms carrying the spinning rolls, in addition to the yielding pressure of the springs, **which arrangement was embodied in defendant's machine and patented in defendant's patent.** See, for instance, claim 37 of defendant's patent 1,119,326 (Vol. 2, p. 48), put in evidence by *Plaintiff,* which reads as follows:

> "37. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism adapted to pass radially across the core for forming the material on the sides thereof, *automatic means for holding said mechanism laterally against the core, and means for varying said lateral pressure at will.*" (Italics ours.)

As Plaintiff construes and here illustrates his State patent, it is a direct infringement of this claim granted by the Patent Office to the patentees of Defendants patent in spite of the careful consideration of the prior State patent. The "automatic means for holding said mechanism against the core" is the green springs, and the "means for varying said lateral pressure at will" is the blue pivoted lever with its slots engaging the yellow arms of the spinning rolls.

The injection of this blue element is *wholly unauthorized* if this illustration is intended to represent the patent in suit, and it must be so intended

because Plaintiff is here discussing infringement. The question of infringement cannot be determined by comparing Defendant's machine with Plaintiff's commercial machine. The comparison must be between Defendant's machine and Plaintiff's *patent*. This point is regarded as of much importance because of the effect that these misleading illustrations are calculated to have.

Furthermore, Plaintiff shows two springs (green) on each spinning roll arm, one a leaf spring and one a coil spring. There is no showing in the patent of two springs on each arm.

Again, the main views show the spinning rolls operating upon the tread portion of the tire and the little views show the spinning rolls operating at the edges of the tread portion. But the Disclaimer has now limited all the claims to the operation of the recited elements "beyond the tread portion" and, as Plaintiff's expert Browne admits, when Defendant's spinning rolls are in this position, they are operating at right angles to the plane of the core (Vol. I, p. 73). This position is shown in the cut on page 151 of our main brief, and the result of this operative position is that there is, as testified by Waterman (Vol. I, p. 278, Q. 64), no radial stretch in the normal operation of Defendant's machine.

None of the quotations from Defendant's patent, presented on page 129 of opposing brief, says anything about radial stretch. They emphasize the circumferential stretch, but they merely say that the sides are *formed* by the rolls. Thus, there is not only silence as to radial stretch, but there is implied negation thereof by the apposition of the word "formed", when referring to the side portions,

to the word "stretched", when referring to the tread portion.

The point is just this. Plaintiff has a patented machine which can be equally well used for either the single stretch or double stretch method. The specification gives no directions as to either method. Therefore, he cannot prove infringement by showing that Defendant's machine has elements which can be used for the double stretch method, so long as the said elements can also be used for the single stretch method. The vice of the matter lies in Plaintiff's endeavor to save his machine patent by construing it as for a particular method—but this situation rests wholly upon Plaintiff's shoulders. Opposing brief lays emphasis (p. 126) upon the testimony of Curtis that one of the Thropp Companies was "using about 12 per cent. [circumferential stretch] as a standard now"; but this is loose language, because the Thropp Companies do not *use* the machines, they only manufacture them; and the testimony, by the use of the word "now" referred to the year 1919, when the testimony was taken (Vol. 1, p. 285), which was five years *after* the Bill of Complaint was filed. Furthermore, the very next question and answer of the witness is as follows (Vol. 1, p. 300).

> "x-Q. 67. What is the general stretch that is used by Thropp machine users?
>
> "A. It varies in different factories. Each one has their own idea in regard to stretch. It varies from what I hear Mr. Walch say up to about *eighteen* or *twenty* per cent. In fact he is the first one that I heard say they stretch six per cent. That is very little stretch. It runs to about *eighteen* or *twenty per cent.*; some places use *eighteen* per cent." (Italics ours.)

Plaintiff has not proved that Defendant made, sold, or used, prior to the filing of the Bill, a machine which made tires by the double stretch method, and this he must have proved, under his own present construction of his patent, in order to establish infringement, under the unquestionable rule that infringement is a tort and must be proved by Plaintiff. The *prima facie* utterances of his expert were shown by cross-examination to be merely inferences and assumptions (see our brief, p. 147) and Plaintiff never supplied this deficiency with any evidence directed to any period prior to the filing of the Bill, as required by law.

In the case of *Ottumwa* v. *Christy*, cited on page 131 of opposing brief, the italicized expressions were not in the claims.

Belgian Patent.

This has been quite fully covered in our main brief, but we would call attention to the statement on page 140 of opposing brief that the fact that there is circumferential stretching places this patent in the single stretch class. This is by no means accurate, since there is, of course, circumferential stretching in the double stretch class.

On page 141, it is said that our exhibit Belgian machine is by no means representative of the machine actually disclosed in the Belgian patent. It is noted, however, that Plaintiff's witnesses did not see fit to take exception to the said machine, and that the evidence is that this is the same machine that was before the Court in the *Firestone* case, except that it has been modified in very slight

17

respects so as to conform to the criticisms made by Plaintiff in that case (Vol. I, pp. 241, 242).

On page 143, and at other places, Plaintiff emphasizes that the professors disagreed as to the translation of the Belgian patent. The sole disagreement was as to whether the word "pucker" or "wrinkle" should be used. We are perfectly satisfied to have the Court use either of these words.

The cut on page 146 is very misleading. Even if two pairs of conical gears were employed in the Belgian patent, they would not only fail to curve the fabric around the core as illustrated in this cut, but they would actually *prevent* it from thus curving around the core, because they are spaced further apart than the width of the core and would, therefore, hold the fabric edges out from the sides of the core, as illustrated in the photograph No. 6 opposite page 110 of our main brief. This photograph is a reproduction of a sworn exhibit. However, this point is settled against Plaintiff because his own expert asserts that there is, in fact, only *one* of these gears shown on each side in the Belgian patent (Vol. I, p. 475) and that such an arrangement could not produce any puckering or plaiting of the fabric (Vol. I, p. 512). Therefore, the machine, as Plaintiff's expert says it should be, could not possibly produce the puckering or the shape shown in cut on page 146 of opposing brief. In order to be comprehensive, Defendant's exhibit of the Belgian machine was made with a pair of gears on each side, and arranged so that the upper gear of each pair could be removed through open bearings, so that the machine could be operated in both ways. These gears are, at any event, trivial attachments and the machine will operate perfectly satisfactorily without them (Vol. I, p. 280, Q. 69).

On page 159, opposing brief says that the Sixth Circuit Court of Appeals could not find anticipation in the Belgian patent, and then gives a quotation from that Court's opinion in which it is held that the Belgian patent is "a complete anticipation" of State in so far as the issues here at bar are concerned.

Its anticipatory effect was, we submit, emphatically recognized by Plaintiff's filing of the Disclaimer promptly after the decision of the Sixth Court of Appeals.

Attention is directed to the *admission* on page 160 of the opposing brief that *the Belgian machine in evidence can be operated according to the State mode of action and with State's results.*

Of the three cases cited at the bottom of page 169 of opposing brief, the first was a five to four decision; the second included three opinions, one dissenting and one doubting; and the third was reversed in 123 F. R. 869, which decision was unanimously affirmed by this Court in 198 U. S. 399.

The Disclaimer.

In order to raise a distinction to meet our argument that what Plaintiff has done by Disclaimer, should have been done by Reissue, if it could have been done at all, Plaintiff says, on page 190 of opposing brief, that a Reissue is applicable "only when the nature of the invention * * * has been altered". This is a very inaccurate legal proposition, because the Statute says in so many words (R. S. Sec. 4916) that the Reissue must be for the "same invention", and this Court has uniformly so held. *Seymour* v. *Osborne*, 78 U. S. 516; *Ball* v. *Langles*, 102 U. S. 128; and many other cases.

On page 196, opposing brief suggests a modification which might have been made to a claim in the *Eibel* case, which modification it contends would have been proper by way of Disclaimer. It is most apparent that the suggested modification is in no way comparable to the lengthy and complex interpretation which has been added to the patent by the Disclaimer at bar. Furthermore, without going at length into the matter, it might be suggested that such a Disclaimer would certainly not have been proper, if it had limited the apparatus to use only upon stock containing 70 per cent of water, as the apparatus in the present case is limited to operation upon unshaped fabric; that it would not have been proper if the apparatus had been limited simply to "fast" travel by gravity, as distinguished from some specific or relative speed; and that it would not have been proper if the apparatus had been limited to operating only upon a portion of the stock handled by the elements, as the apparatus in the present case is limited to action only beyond the tread portion. The distinction can be expressed in a few words, to wit: the suggested language for application to the claim in the *Eibel* case merely specifies a result of the apparatus recited; while the Disclaimer in the case at bar limits a specified apparatus to a particular method of operation so that two identical apparatuses could be simultaneously operated side by side and one of them come under the claims while the other did not.

Respectfully,

LIVINGSTON GIFFORD,
E. CLARKSON SEWARD,
THOMAS G. HAIGHT,
Counsel for Petitioner.

No. [redacted]185.

JAN 9 1924
WM. R. STANSBU
CLER

In the Supreme Court of the United States

OCTOBER TERM 1923.

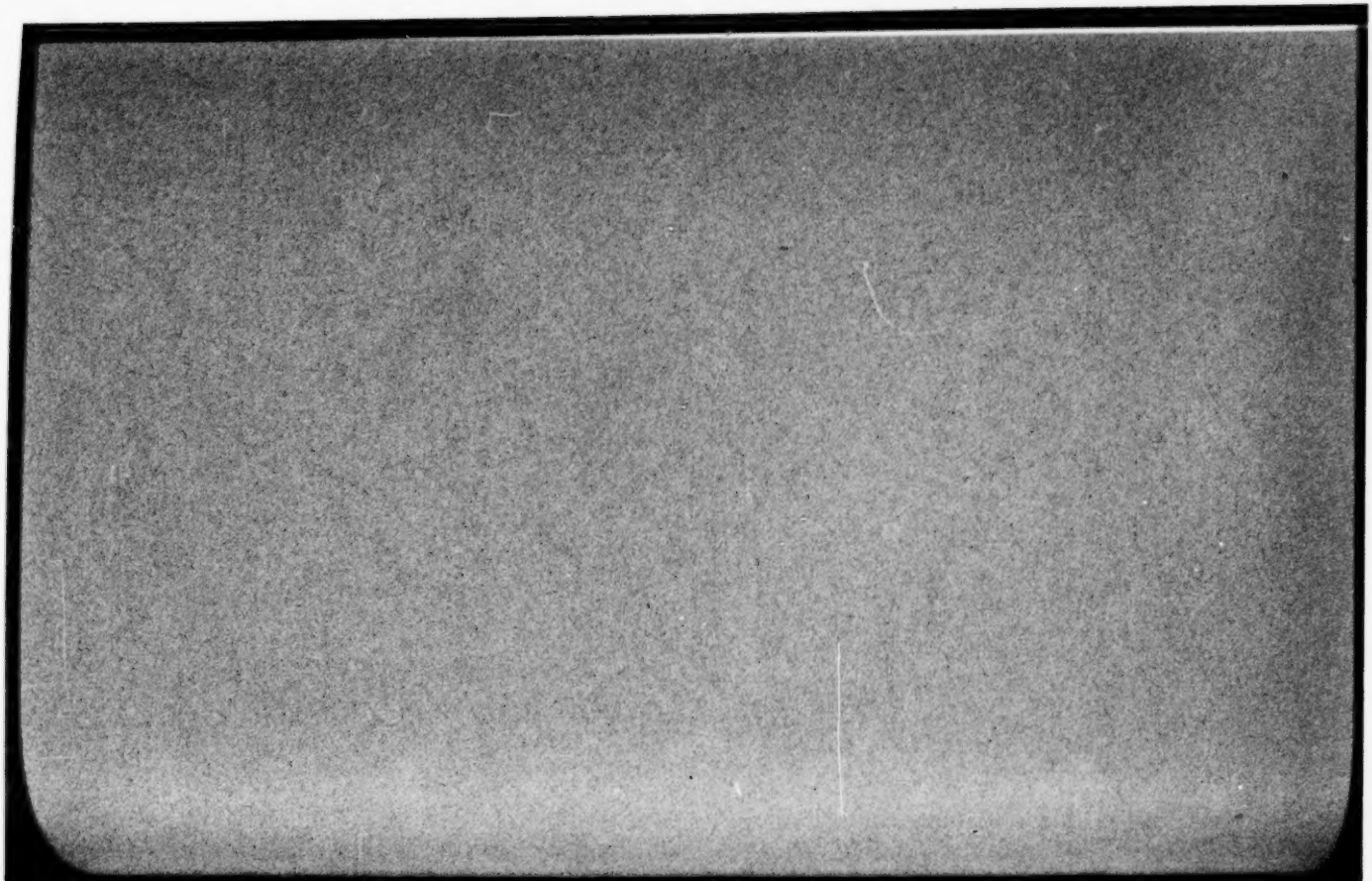
THE JOHN E. THROPP'S SONS' COMPANY
Defendant-Appellant,

vs.

FRANK A. SEIBERLING.
Plaintiff-Appellee.

BRIEF—AMICUS CURIAE.

HARRY FREASE,
Canton, Ohio,
Amicus Curiae.



No. 185.

In the Supreme Court of the United States

OCTOBER TERM 1923.

THE JOHN E. THROPP'S SONS' COMPANY
Defendant-Appellant,

vs.

FRANK A. SEIBERLING.
Plaintiff-Appellee.

BRIEF—AMICUS CURIAE.

HARRY FREASE,
Canton, Ohio,
Amicus Curiae.

SUBJECT INDEX.

BRIEF—Amicus Curiae 1

Prior Practice 2

William W. Duncan 2

Tod J. Mell 8

Walter S. Koplin 11

Charles H. Drach 12

Cary D. Derry 13

William Heller 14

Louis Stark 14

William G. Green 15

Warren C. Gregg 16

Mark W. Roe 17

Harvey J. Bittaker 18

Talcut I. Curtis 20

Thomas A. Walch 20

HAND SPINNING ADMITTED BY STATE 23

Arthur R. Mackey 25

HAND SPINNING NOT ENTIRELY MANUAL 26

Prior Patents 28

Seymour Patent No. 80,836 28

Seymour Patent No. 376,167 31

Dewey Patent No. 438,407 33

Moore Patent No. 518,112 36

Jeffery Patent No. 607,245 39

Seiberling and Stevens Patent No. 762,561 40

Vincent Patent No. 794,473 44

Mathern Belgian Patent No. 194,731 47

Arthur S. Browne 47-60

Plaintiff's Assumed Theory 49
Operation of Mathern's Spinning Rolls 59
Amount of Pressure Required 62
Action of Centrifugal Force 65
Plaintiff's Theory of Belgian Patent 66
Radial Stretch Theory 71
Judge Buffington's Opinion 72
Judge Denison's Opinion 73
Facts Do Not Fit the Theory 74
Beneficial Function of Centrifugal Force 75
State Patent No. 941,962 77
Method and Mode of Operation 79

Authority Cited.

Robinson on Patents 79

No. 185.

In the Supreme Court of the United States

OCTOBER TERM 1923.

THE JOHN E. THROPP'S SONS' COMPANY

vs.

FRANK A. SEIBERLING.

BRIEF—AMICUS CURIAE.

A careful reading of the transcript and a consideration of the exhibits impresses one with a feeling that the issues involved can be readily resolved by a review of the fundamental defense of anticipation, and the less fundamental defense of no invention over the state of the art; and with a belief that such a review will naturally solve the other defenses which have been presented by the record, and which will no doubt be discussed more or less by Counsel for the respective parties to the suit.

The fundamental defenses referred to are based upon the alleged prior use and general knowledge of the method or process which may be carried out by a machine embodying the disclosure of the State patent in suit; and upon the existence of sundry prior patents, especially the Mathern Belgian patent, which are alleged to disclose machines containing the same combinations of parts which are included in the claims in suit of the State patent, by which automobile tires have been or can be built by the same mode of operation which is said to be inherent therein.

In any art, the knowledge, or at least the perception, of a process or method must necessarily precede the conception and development of a machine or apparatus for carrying out the process; and as in the present instance the history of the immediate art shown by the record seems to have followed this natural course, it will be more convenient to consider First, the method or process of building tires for which the State machine may be used; and Second, the prior patents which may anticipate the claims of the State patent as the same stand subject to the disclaimer of record.

PRIOR PRACTICE.

The defense of prior knowledge and general use of the method or process which may be employed for building tires by the machine of the State patent, is based primarily upon the testimony of numerous witnesses to the effect that automobile tires were previously built on rapidly rotating cores by means of spinning wheels manually applied, in the same manner that such tires are built upon the State machine.

William W. Duncan of Watertown, Mass., president of The Hood Tire Company engaged in selling automobile tires made by The Hood Rubber Company since 1914, who is also manager of the tire department of the manufacturing company, which began making tires by hand in the spring of 1906 and continuously made them by hand from 1906 to 1911 (I-191, 2)*; described how the fabric was placed on the core, as follows:

> "The core was mounted upon what was termed the spider, this spider consisting of a hub with three radial arms. Upon one of the arms was attached a handle for the purpose of rotating the spider and

* Reference to the Transcript of Record.

core. The hub was bored to fit upon a projection of the supporting arm *upon which it would revolve.** This supporting arm was curved in such a way as to miss hitting the core by about four to six inches, and then curved back into the line of the plane of the core, continuing in the line over the top of a bench. It was held on the top of the bench by two clamps one of which contained a set screw, so that the core and spider could be held either in a vertical or a horizontal position, or any position between, by clamping or unclamping the set screw.

"For applying the fabric to the core, the core was placed in vertical position; a piece of fabric was furnished the operator of proper width to cover the core from side to side and approximately *twelve per cent less in length* than the circumferential measure of the top of the core. I have omitted to mention that on the hub of the spider was a pawl attachment whereby the pawl engaging with the hub could hold the core fixed in one position" (I-192).

"The operator took one end of the fabric in his hands, throwing the balance of length over his shoulder. He cemented a small spot on the top of the core and attached the end of the fabric to this spot. He then *stretched the fabric* from that spot onto about eighteen inches of core circumference. Then moved the position of the core so that the point of contact with the fabric was again at the top position, setting the pawl to hold it again in that position, and again stretched the fabric another twelve to eighteen inches of the circumference. He continued the stretching operation until the piece of fabric covered the entire circumference at the top of the core section, and lapped the end of the fabric about one inch over his starting point.

---

*Italics used arbitrarily to emphasize important points and render subsequent reference thereto unnecessary.

"This left the core with an endless piece of fabric covering its outer circumference and because the fabric was shorter than the outer circumference of the core, *made it conform to the cross section contour down to a point between one and one and three-quarter inches from the center line of circumference.* This amount would vary with the size of the core; on a three inch core it would contact about one inch from the center line of circumference; on a four and a half inch core it would contact around one and three quarter inches. But the point of contact on the side would always end at approximately the same percentage height above the cutting line of the core. By the cutting line I mean the point at the so-called toe of the bead where the tongue of the core attaches. It is approximately the point at which the toe of the bead is trimmed for removing excess width of fabric" (1-193).

"At the edge or end of the point of contact of fabric on the shoulder of the core, the remaining width of the ply *stood out at approximately right angles to the core,* because that was the length to which the fabric was cut before application. It was then necessary to apply these skirts of fabric as we called them to contact with the remainder of the core as far down as the cutting line. This was done with what was called a *stitching or spinning roll,* which was simply an enlarged cake or pie crust cutter with a larger wheel. The ordinary size of spinning wheel ran from one and a half to two and a half inches, and the edge went down to a sharp cutting edge just blunted over by spinning against an oil stone. This was a metal roll or wheel. The wheel was held between two supports in the shape of a yoke and a wooden handle attached.

"The ordinary method of operation for using this roll or spinning tool on the fabric and core for applying was to unclamp the set screw on the bench and turn the core and spider from a vertical to

approximately a forty-five degree position, then to clamp the supporting arm so as to hold the core and spider in that position. The pawl was then released from the hub so that the core and spider could revolve on the support, and with the handle previously mentioned as attached to one of the arms of the spider, the core was *revolved rapidly.* Because of its *weight,* approximately one hundred and fifty to two hundred and fifty pound, *it would maintain its speed of revolution for some considerable time.*

"While it was revolving the operator would take the spinning tool in his hand and apply it to the revolving core and fabric at the end of the point of contact caused by the stretching, allowing it to revolve against the fabric and core with manual *pressure applied.* He would then *gradually move it down, as the core and fabric revolved,* in a radial line, towards the cutting point of the core, until the fabric was completely applied to the entire surface of the core on one side. The operator would then shift the position of his core and spider to approximately forty-five degrees on the opposite side of the vertical position and with his spinning tool apply the opposite side or skirt of the fabric in the same manner.

"While it was ordinary practice to spin down one side at a time, I have seen workmen spin it in a vertical position using a roller in each hand to save time. But as I say, it was not ordinary because very tiring" (I-194).

"The following plies of fabric were applied in the same way until the proper thickness of tire carcass was built up."

"The method as described above of putting down one side at a time was used from 1906, by all our operators. The use of a roll in each hand was not at all ordinary. It was too hard on the men to use the two rollers throughout a day's work."

"At that time I was manager of the experimental department, which made out all construction and operating orders for mill methods."

"I not only saw it, but did it myself."

"The fabric stood out at approximately *right angles to the plane of the core.* The roller was applied to the fabric on the core at approximately an *angle of forty-five degrees* to the plane of the core" (I-195).

On cross examination, Duncan testified as follows:

"We have made tires with stretch from eight to twenty-four (per cent). *I used twelve because it is about as much as the ordinary hand worker will pull.* This might vary on an actual hand made tire as high as seventeen per cent."

"This will vary with different companies. We preferred to get seventeen."

"Because that brought what we called the neutral line of fabric to the best position on the side of the tire which could be obtained with manual stretching" (I-197).

"When the fabric is cut to a length and width for application to the core, it is cut on the bias, and the warp and filler lines are at forty-five degrees angles to the length of the strip, or a ninety degree angle to each other.

"In order to apply such a flat strip to the entire surface of the core, it is necessary to make the length of the strip at about a *medium circumference* of the core.

"As it is stretched on at the top of the core, the warp and filler yarns naturally change from a ninety degree angle to each other. *From that point to the cutting line, the angle is again changed to a greater than ninety degree difference relative to the circumferential line.* The road service shows that the nearer this neutral line, or the point at

which the warp and filler threads remain at a ninety degree angle, is to the bead seat position of the rim on the tire, the better the tire will run. A seventeen per cent stretch brought this line down *toward* the cutting line of the core about as far as could be obtained by manual stretching" (I-198).

"That (method of hand spinning) was the way we told all our operators."

"*The only time* that a saw-tooth movement of a stitcher or a spading tool need be used is when a wrinkle develops in the application by the spinning roll in the hand spinning which *necessitates lifting the fabric from the core* and straightening out the wrinkle. With a skilled operator who did not move his spinning tool too rapidly toward the cutting line in the radial line of the core, the necessity for the use of a saw-tooth movement or the spade for straightening out a wrinkle never developed. If the operator moved the tool too rapidly, he might develop one or two wrinkles which would be removed by the saw-tooth or the spade" (I-199).

"In such cases, which were very seldom, we always used the spade, in substantially a radial direction at the place where the wrinkle occurred to eradicate it" (I-200).

Upon being asked what amount of pressure was being employed to hold the stitcher against the core, Duncan replied that:

"In determining the amount necessary to apply on machine rollers, we found that tests on the hand pressure as near as we could develop amounted to about a one hundred pound spring."

"I should say it would vary from twenty-five to a hundred and fifty pounds according to how tired the man was" (I-200).

Upon being asked whether there was any tendency of the hand held roller to slip when on the side of the

core when great pressure was applied to it, Duncan answered:

> "Not when a spinning wheel of about two and a half-inches diameter was used. A small wheel would have a tendency to let the skirt of fabric catch the supporting yoke and jerk it out of position. * * * The first wheels were about an inch in diameter but were almost immediately increased from two to two and a half-inches. * * * The smaller ones were abandoned" (I-201).

Upon being asked whether in two successive operations, the first on one side of the core, and the second on the other side of the core, the amount of pressure would be uniform, he replied that—

> "I should say very unlikely, but it is immaterial, providing the fabric is applied smoothly. * * * I mean the circumferential stretch because that governs radial stretch" (I-202).

Upon being asked whether he regarded the circumferential stretch applied initially as the important thing and the side pressure subsequently applied as relatively unimportant, Duncan's testimony was that—

> "The amount of side pressure need be *only sufficient to apply the fabric smoothly. The adhesion is obtained during the molding operation*" (I-203).

And upon being asked whether there was any difference in product due to the personal equation or due to possible vagaries or lack of attention he replied that—

> "We did not notice any, we had a good inspection system" (I-203).

Tod J. Mell of Akron, Ohio, technical adviser to the superintendent of The Firestone Tire & Rubber Company, was connected with The Republic Rubber Com-

pany of Youngstown, Ohio, from 1905 for eleven years, first as manager of the tire department for five years, and then as experimental engineer (I-152, 3). Mell said that they made tires by hand at the Republic company in the fall of 1905, and got the department well under way in 1906, and described how the fabric was put on the core, as follows:

> "The fabric was cut the proper width on the bias, a strip made the proper length to reach round the core of the tire, *after being stretched.* I should have said at first that the core was cemented, in order that the fabric would stick to the iron. After the ply had been stretched on the core and spliced, it was rolled down, starting at the tread and working down well over the sides. As the fabric was stretched, it tended to lay down to some extent over the sides of the core. The operator, after he had rolled the tread, *rotated the core until a sufficient speed was obtained,* and then, at first by means of his roller, *and later with his stitcher,* rolled the fabric on to the core" (I-153).
>
> "The motion was then stopped and the tire turned in a horizontal position; and in this position the operator finished working the fabric on to the core. The plies were put on in this manner until sufficient plies under the bead had been placed; then the bead was placed and additional plies of fabric stretched, and rolled on to the tire; after which the tire was trimmed at the bead and the rubber side wall and tread applied. The tire was then *cured* in the usual manner that all full-molded tires are cured in" (I-154).

Mell said that "*Owing to the centrifugal force, the edges of the fabric stood away from the core to some extent*"; and that the method described by him was *the regular practice at the Republic Company in 1906* (I-154).

Upon cross examination, Mell said that the method described by him "*Was the accepted method up until the time a machine was used,*" and that *no other method was employed in the Republic plant,* "Except possibly experimental method or methods." Also that the same method was used on all sizes of tires by the Republic company "*Up to and including 5-inch*" (I-155).

Upon having his attention called to the "reciprocating stitching method," Mell testified that:—

> "After the fabric was applied to the core and the tire spun and the operator had worked down with his stitcher, while the tire was spinning, all the fabric that he could, he stopped the core and used the paddle, and sometimes a stitcher, to stretch the fabric and make it lay smoothly the balance of the space to the inside diameter of the tire. I wouldn't say that he worked it down that way. The path shown in the sketch is at an angle with the radial line of the tire. The method used in stretching the fabric on with a paddle was to stretch very *near to the radial line;* In other words, we worked towards the axis of the tire, instead of at an angle" (I-155, 6).

Upon being asked whether the Republic company ever employed the reciprocating stitching action all the way down to the bead line, Mell said that—

> "*I do not believe that we ever did.* All of the tires were rolled down to some extent, varying with the experience of the operator, before the paddle was used" (I-156).

When asked whether on a small core having a cross section of say three inches, with a fabric stretch of 18 or 20 per cent elongation, there was very little additional forming action necessary to apply the fabric to the side of the core, Mell replied that—

"Yes, not a great deal of the additional forming need be done. However, the fabric had to be applied without wrinkles; and even on a small tire this took considerable care, the fabric *never coming down* where it lay on the core in its correct position.

"Certain companies, in order to make the operation of applying the fabric easy, stretch their plies to a considerable extent; but even when this is done I would not say that they relied principally upon the stretch, as it was *always necessary to place the fabric in its proper position by other means*" (I-157).

Walter S. Koplin, an employee and sometime inspector of The Firestone Tire & Rubber Company, was engaged with The Diamond Rubber Company in the work of making hand built tires some four years from 1903, and served as an inspector for seven years thereafter (I-92, 3); described how they put the fabric on the core when he built tires there by hand, as follows:

"We stretched fabric on by hand, and we made our splice; then we rolled it on top—Oh, about three inches, I should judge; and we were *supposed* to stitch it down, but when a man got used to it they would start the core to *spinning as fast as it could* and the *fabric stuck out*—why, we let it run that way until we got clear down to the bead. Then, of course, it would bring it down into the groove of the bead and then right over the edge" (I-93).

On cross examination, Koplin testified that in breaking in new men the rule was to "*To stitch the plies down by hand,*" but that "*After we would break them in, they would naturally break away from the hand building, and as I told you before, spin the tire*" (I-96).

On being asked how much weight he estimated is used in Firestone machines for holding the stitcher or

forming-roll on the tire against the core Koplin answered—

> "I should say *there isn't any more than a man can use.* * * * Just what a person could bear his weight against there, and his strength too—bears right up against the tire. * * * I should judge it would be about 30 or 40 lbs" (I-98, 9).

Charles H. Drach of Akron, Ohio, an employee of The Firestone Tire & Rubber Company, worked for The Diamond Rubber Company for three months in 1905, and went back in 1906 and worked there about four years and eight months (I-99). When he went to the Diamond in 1906 he built tires by hand, and described how he put the fabric on the core, as follows:

> "Well, we first cemented the core, and started the ply on top of the iron core, and pulled it around; then we took and *spun the core real fast,* and *held stitcher against it, right down to the bead line*" (I-100).

Drach says that when he spun the core real fast the edges of the fabric were "*Right out, right out straight*"; that when he went to the Diamond company in 1906 he did this spinning down of the fabric—

> "Right away, when the rest of them was doing it I started, right away. * * * They all done it, the gang I was in, twelve men" (I-100).

On cross examination, Drach referred to the so-called "stitching method" and said that "*It drawed the stock to the core more by spinning it than it did by stitching it*" (I-103); and upon redirect examination, he said that in his own experience he got "*More stretch with spinning*" (I-105).

Cary D. Derry of Kent, Ohio, an employee of The Firestone Tire & Rubber Company worked for The Diamond Rubber Company in the forepart of 1904 in making hand built tires (I-107); and described how they put the fabric on the core in building those tires by hand, as follows:

> "Well, we pull the fabric on by hand. The core is cemented all over. We pulled it around by hand. And to stitch the fabric down you were supposed to stitch it by stroke. Practically all of them did" (I-107).

Derry further testified that they "*Spun the core and used the stitcher*"; also that when they spun the core the fabric took "*Kind of an upward course, flared out*"; that they spun the core "***Fast as we could***" (I-107); and described the use of the stitcher when they spun the core, as follows:

> "Well, spin the core, get it going *as fast as you could;* take your stitcher and hold it just about that angle, as near as I can tell you; be *about forty-five degrees*, wouldn't it" (I-108).

On cross examination, Derry explained that they spun the core to give it a high velocity—

> "To make your number good deal easier, to *get the speed to pull the fabric down.* Run it on low speed, wouldn't flare out; *on high speed, it would flare out.* * * * So that the fabric wouldn't wrinkle" (I-111).

Derry said further that if you rotated the core at a less velocity:

> "The stitcher *wouldn't take a hold.* If the fabric *wouldn't flare out,* the stitcher wouldn't take hold. As fast as the core would go the fabric would flare out and *give the stitcher a chance to take hold*" (I-112).

As to the amount of pressure exerted in holding the stitcher or forming roll against the side of the tire, Derry said that *"I should judge in the neighborhood of 25 or 30 lbs., along there, as near as I can tell you"* (I-112); and also that *I don't think there would be very much of a variation"* of pressure on the two sides of the tire (I-113).

William Heller of Akron, Ohio, an inspector of tire carcasses at the factory of The Firestone Tire & Rubber Company, started work with The Diamond Rubber Company in 1901 and stayed there for about four years, and started building tires in 1902 (I-115), as follows:

> "At the time, why, we pulled it on in first place on wooden core, and then we experimented getting it down most any ways; used to pull it down with pliers, wire pliers, nail it fast with tacks, tacked it down; worked it down, stitched it down, worked the core; then we used to have a paddle there; we used to chop it down; that's what the boys used to call it them days—chop it down" (I-116).

About two years later, in 1904, they began making tires on iron cores, as follows:

> "I pulled the fabric on in the ply. Always cut in plies. And then, after the plies were on the tire, splices made, either stitch it down by hand *or whirl the core, hold the stitcher against the core and spin it right down"* (I-116).

Heller said further that they whirled the core *"Just as fast as we could. That depends on the size of the core. Heavier the core the faster it spun"*; and that when the core was spinning fast, the edges of the fabric took a position *"straight out"* (I-117).

Louis Stark of Akron, Ohio, General Tire Department foreman of The Miller Rubber Company, began making tires by hand at The Diamond Rubber Company

on wooden cores in 1901 and 1902, and on iron cores about 1903 (I-125, 6). Stark said that the fabric was put on the iron cores, as follows:

> "We pulled the fabric on by hand. The first ply was made up in an endless band. * * * Pulled them on by hand. * * * Well, there is a number of ways you could do that. I used to do it the quickest way—*spinning the core*, holding your stitcher on the side of the fabric and *running the ply down*. * * * Well, I started it right after I started to build tires there on iron cores. * * * Well, now, I don't know as I can say just how fast the core was going; but you had to spin it *just as fast as you could possibly get it to spin*. * * * Well, the faster you would spin the core, the *fabric would stand out* like this,—*right out straight from the core*" (I-126, 7).

On cross examination, Stark thought he was able to press the stitcher against the core *with the same amount of pressure as that now ordinarily imparted to a spinning or forming roll in the present well-known form of carcass making machine*, and testified as follows:

> "I couldn't say how much pressure I did put on. I never had any idea at all. I *always got enough on there to get them down where they should be*" (I-128).

In further cross examination, Stark said that he did not think the pressure was great enough to retard the rotation of the core "*because it kept on spinning all the time*" (I- 129).

William G. Green of Akron, Ohio, an employee of The Firestone Tire & Rubber Company ever since 1906, was previously employed by The B. F. Goodrich Company, and while there made automobile tires on iron cores (I-136). Green described how they put the fabric on the cores when he made tires at the Goodrich plant, as follows:

"We hung a core up on posts. We had posts with pins sticking out, and we hung it up by hand and pulled the fabric on.

"We had to *spin the table* around and *stitch it down by hand.*

"Why, we had a revolving table, and use a paddle sometimes, and *lots of times we used the stitcher most of the time,* well, *biggest part of the time.*"

"(It) was a ball-bearing table, and they whirled it, see? get it going *fast,* and they held the stitcher there." (I-136, 7).

Green testified further, that he did that himself and that he had seen other men at the Goodrich plant stitch down the fabric by whirling the core as described; and upon being asked what position did the edges of the fabric take, replied:

"Well, the upper edge of the fabric on top *would flare up, naturally*" (I-137).

Green also said that the core was whirled "*as fast as we could whirl it. The faster the better.*"

Warren C. Gregg of Akron, Ohio, an inspector of tires at The Firestone Tire & Rubber Company for some eight years, worked for The Diamond Rubber Company twice before that time, leaving the first time in 1907 (I-146, 7); and when he was there the first time, made tires by hand, as follows:

"We had, to start with, a band; it was an endless band; that two of us stretched over a core. Then we worked it down with a stitcher.

"Well, if we worked it down according to our instructions, it was done with stroke. Often they would spin the core, and then would *hold the stitcher against the sides* of the core; hold the stitcher

there—of course, if we had speed enough to start with, we would run it clear down.

"Well, we figured on spinning it fast enough to make it run until we got this fabric run down to the bead line" (I-147).

When asked what position did the edge of the fabric take, Gregg answered—"*Why, ordinary stand straight out, flare out*"; and said further that he saw other men spin down the fabric in this way at that time (I-147).

Mark W. Roe of Akron, Ohio, a Mechanical Engineer engaged as Consulting Engineer with The Republic Rubber Company since 1917, was Assistant Engineer with The Diamond Rubber Company, and its successor The B. F. Goodrich Company, from April 1907 until August 1915 (I-167). Roe testified that tires were made by hand at the Diamond Company in 1907 and described how the fabric was formed on the core at that time, as follows:

"The fabric was received by the men cut in bias strips. The ends of these strips were placed upon the core and stretched around the core by the manual power of the operator, after which the core, with the ply of fabric, was revolved by hand, and *spinning wheel or stitcher*, hand-operated, was used for stitching down the fabric around what would form the bead."

"The core was caused to rotate by the left hand of the operator, spinning tool being held in the right hand, the spinning end of the tool downward, and forced against the tire, usually starting from the center or outside periphery and *worked in a spiral line*, forcing the fabric to the core, as the spinning tool was advanced, *radially* toward the center of the core.

"It would be hard to say, but I should judge (the core is rotated) from 50 to 60 revolutions per minute. It would average about that" (I-167-8).

On cross examination, Roe testified that—

"So far as I remember, wrinkles or uneven places obtained in stitching a tire were smoothed out by paddle or stitcher along the principle as shown in the 'Sawtooth Path Sketch' " (I-170).

"To the best of my knowledge, it was in common use at the Diamond plant,—to stitch them down that way. I mean in common use to stitch them down by the stitcher, *by rotating the core*" (I-171).

Upon being asked whether the *amount of pressure* exerted on the stitcher in following the spiral path is more or less immaterial, Roe said that—

"No, it should not be less than a certain amount, nor greater than a certain other amount, the definite limits of which I have not fixed."

Harvey J. Bittaker of Akron, Ohio, Assistant Manager of the Cord Tire Department of The Firestone Tire & Rubber Company since 1913, was employed from 1896 to 1913 as inspector and foreman in the Bicycle Department and as inspector and foreman in the construction of automobile tires with The Diamond Rubber Company (I-173, 4). Bittaker said that The Diamond Company began making automobile tires on iron cores about the year 1900, and continued that practice until sometime thereafter, and described how they put the fabric on the iron core, as follows:

"The construction of the tire began by the application of a first ply, which was put on in a band form. The core was then *revolved*, and the plies were stitched down on the side of the core, additional plies being added that were not put on in the band form were rolled and stitched down in a similar manner" (I-174).

"There was no roller used on the band ply; but the several additional plies were rolled down,

that is, on top of the core, with a flat roller, and some with a curvature roller. They were rolled down to a point on the core about half way between the top and the bead line. *Then the stitcher was applied,* and the balance of the fabric was stitched down with a stitcher about three and a half inches in diameter, and about a one-sixteenth inch face" (I-174, 5).

"In the early stages of the tire construction, *rotating of the core while stitching down the plies* was sort of termed as a criminal offense among the employees. Shortly after the tire construction had advanced, *it was more common to see the workmen rotate the core at a very high speed* while applying the fabric with the stitcher" (I-175).

"About the year 1902 or 1903" (I-175).

"The edges of the fabric were sort of *flared out or spread out* on the sides while the core was being rotated" (I-175, 6).

On cross examination, Bittaker explained why the hand-spinning operation at the Diamond plant was regarded as a species of criminal offense, as follows:

"In the beginning of tire construction, it was more *theoretical* than anything else that the threads of which the fabric was composed could not be kept at a 45-degree angle while being applied to the tire, if stitched down *while the core was rotating;* but, after the mechanics who were studying the proposition got into it more thoroughly, they found out that applying the fabric while the *core was spinning* was not detrimental to the tire, as they had previously thought" (I-180).

In explaining why the workmen preferred to use the hand spinning method, rather than this saw tooth method, Bittaker said that—

"The fabric could be applied more easily and in less time, naturally."

"They considered that the hand spinning was not so laborious. It was easier, but wasn't quicker. Easier on their arm. That was the point."

"Yes, it was quicker as well as easier" (I-182).

Talcut I. Curtis of Trenton, N. J., was demonstrator for the DeLaski & Thropp Circular Woven Tire Company, and made tires for them by hand in 1905 (I-293). He described how he put the fabric on the core in making tires in 1905, as follows:

"We mounted the core on a three pronged spider stand, cemented the core, stretched the fabric on, spliced it, and then rolled it down with a three-inch stitcher, *rolling* stitcher.

"The rolling down I did in two ways: First, holding the stitcher with both hands, *by rotating the core first*, holding the stitcher with both hands, going down one side and then down the other side."

"The other method was in *revolving the core* with the left hand and stitching down with the right, turning the core from the other side—spinning it down" (I-294).

Curtis said further that when the core was rotating in the first method—"The *edges flared out* to a certain extent according to the swiftness of the core" (I-294); and also that he followed the same method at the Empire plant in 1906.

Concerning the use of wooden spades Curtis testified that—

"Well, I used, sometimes the spade at that time. We used them both possibly at that time, some. Some fabric is stiffer than others and so on, and they changed over to the other methods possibly a little" (I-296).

Thomas A. Walch of Trenton, N. J., foreman of the Tire Manufacturing Department of Ajax Rubber Com-

pany, was employed by the Ajax company for thirteen years from 1906 and in that year made tires by hand (I-285, 6). Walch described how they applied the fabric to the core, as follows:

> "Well, we had three and four prong spiders; we would have a slot in the core and we would put it on this spider; then we had a wrench to tighten it up with screws on the top—adjustable screws; you could turn it until you got it tight enough; then we mounted the core and put a little cement across the top and all around the side, about half way of the core; then we started our fabric and started to pull it on just as hard as we could, cut it off and spliced it; and then we would start and turn our core around *just as fast as we could*, and then we would take this *stitcher*, three inch stitcher they called it, a steel stitcher, about a sixteenth of an inch on the point, and we would go right in like that (indicating) toward the bead and the same on the other side" (I-286).

When asked what position did the edges of the fabric take when you turned the core as fast as you could, Walch said—

> "Well *it stuck out*, just like that (indicating) *laid out*" (I-286).

On being asked in cross examination, whether men when they first started would use a wooden spade to spin the fabric down on the core in the way that Walch did it, he answered—

> "No, not with the wooden spade; you had to have it *stationary;* went all around it and took much longer to do it."
>
> "Well, the new fellows that would start in, they would always do it with the spade starting in, because it was quite a knack to do it with the stitcher.

We learned a lot of new men there and they did not quite get the knack of doing it right away" (I-288).

As to whether the quality of fabric tires and their durability has materially improved in the last thirteen years (previous to 1919), Walch testified that—

> "Well, we use the same kind of fabric, very near the same kind of compound. I don't know as they have durability any better. I *believe the hand made tire was considered just as good as far as durability goes as a machine made tire*" (I-288).

On this subject Walch said further that they got as good mileage out of hand made tires in 1906 as they do out of machine made tires today, and that "*They were guaranteed five thousand miles*" in 1906, "*the same as they are today*" (I-289).

As to the amount of pressure to which he applied the stitcher to the side of the core, Walch said that—

> "Well, it was *not a great pressure*—just enough to stick the fabric to the cement; there was some on the inside, just to touch the fabric; very little pressure * * * not to amount to anything; *you had to hold the stitcher steady;* that is the way you held it, the pressure, you didn't have to put on much pressure at all" (I-290).

Walch said that the Ajax company used a stretch of "*six per cent*" in applying the layer originally to the core by the hand spinning method, his experience being confined entirely to the Ajax practice.

In summarizing the testimony of the foregoing witnesses, an effort has been made to include only those statements which are not affected or modified in any manner by the rigid cross examination to which they were subjected; and it is believed that the testimony which has been quoted stands undisputed in the record

and may be accepted as conclusive of the facts set forth therein, without the need of any argument to establish the same.

It is only necessary to note that some confusion occasionally arises from the frequent use of the words "*stitching roll*" or "*stitching wheel,*" to designate the *spinning roll* or *spinning wheel;* and this fact sometimes makes it difficult to understand whether a witness was referring to the "reciprocating" or "saw-tooth" method which may be practiced, either by a "spade" or "paddle" or by a "stitching" roll, or to the "spinning" method which is also practiced by the use of a "stitching" roll.

The testimony of the witnesses will be more readily understood if it is remembered that the "*stitching*" method can only be practiced by hand when the core is stationary or rotating very slowly; while the "*spinning*" method can only be practiced by *rotating or spinning the core very rapidly.*

Hand Spinning Admitted by State.

In view of the common practice of hand spinning tires in many factories prior to the development of the State machine, it is not surprising that the previous use of this method was recognized in the specification of the State patent, as follows:

> "The spinning-rolls 147 are preferably mounted on ball-bearings or similar anti-friction mechanism for they revolve at high speed and exert considerable pressure on the fabric. * * * The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145. * * *These springs exert the pressure against the fabric for forming it against the sides of the core which would be exerted by the arm of the workman in case of a*

hand-tool or a hand-pressed roll" (Lines 93 to 117, page 5 of the State patent. II-19).

Nor is it surprising that the patentee testified to the knowledge of the hand spinning method, prior to the time he began his experiments, as follows:

"Q. 48. Now, I want to call your attention to another alleged system of making tires by hand, which we will call the 'hand-spinning' method, which is distinguished from the sawtooth method you have already described by the fact that a wheel-stitcher was employed to roll down the unattached skirts, the core being rotated with some alleged degree of rapidity, and the stitcher being held in the hand and gradually advanced by the operator over the side of the rotating core. Do you know what I mean by this description?

"A. Yes, I do.

"Q. 49. Was that method ever used in the Goodyear plant prior to the time that you began your experiments you have already referred to?

"A. I never knew it to.

"Q. 50. Had you ever seen that method employed prior to the time you began your experiments?

"A. No, I had not.

"Q. 51. Had you ever heard of it?

"A. Yes, *I had heard of it* (I-308).

"Q. 52. Do you remember how you heard of it?

"A. *I had heard of that through McDonald.*

"Q. 53. But you had never seen it actually—

"A. Had never seen it operated.

"Q. 54. Did McDonald ever demonstrate it, or illustrate it, to you in actual practice?

"A. Yes.

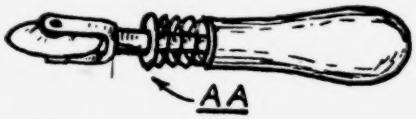
"Q. 55. What was your purpose in having this illustration and demonstration of the handspinning method made to you by McDonald?

"A. I had started an experiment, *and asked him to roll it down for me with the spinning roller.*

"Q. 56. You say that you started a series of experiments some time in the year 1907, with the idea of obtaining a commercial machine. Did McDonald's demonstration and illustration of this handspinning method form any part of these experiments?

"A. It did" (I-309).

The patentee also recognized the prior existence and use of hand stitching rolls, by including an illustration of the same in "Plaintiff's Exhibit No. 8—Sketches of Experimental Work, (3rd Device)"; the same being designated "*A A*" in the sketch, and being described in his testimony as a "Standard Stitcher-Roller" (I-343).



Furthermore, State says that in his "Sketch 15" (II-97), the figure at the top, to the left, entitled "Hand stitcher-wheel," is intended to represent the ordinary hand stitcher-wheel in use prior to the beginning of his experiments (I-368).

And finally, **Arthur R. Mackey,** plaintiff's own witness, who worked for the Diamond company in 1908 or 1909—between 1907 and 1909, first as a tire builder and afterwards as an inspector of tire construction, described an unofficial method employed there for forming the sides of the ply to the core, as follows:

"We first stretched the ply of fabric on the core, and then *spun the core* as rapidly as we could by hand, and then *rolled the fabric down* on the side of the core by a stitcher held in the hand by the operator, *moving the hand inwardly down toward the*

bead. When the plies were stretched on tight and even, we could spin down to the bead, and sometimes out to the heel of the bead" (I-416).

"The stitcher of smaller diameter was the first small stitcher used in tire construction; and afterwards found that the hub of the stitcher would buckle into the plies too often, and larger stitcher was made. These larger stitchers *we got at the hardware store*, our own buy; we bought them ourselves.

"The factories did furnish some, but that was in the first initiating of those first stitchers; and the workmen bought a good many of them themselves" (I-427).

This testimony, produced by the plaintiff, shows that the larger sized stitchers, which were particularly used in the hand spinning operation, were in such common use in 1907 or 1908 that they were obtainable as an article of merchandise in a hardware store.

Hand Spinning Not Entirely Manual.

It is interesting, if not important, to note that the so called "hand spinning" method of building tires is not entirely a manual operation, but involves the use of a circular core mounted on a spindle for rapid rotation, and also the use of a disk-like spinning roll, also mounted on a spindle for rapid rotation; and as each one is a *wheel*, axially journaled for turning when power is applied, to that extent each one is a *machine*, and both were used in carrying out the hand spinning method.

This fact seems to be important because, whether or not "*There is no true combination between State's revolving core and his independent spinning tool*," as was said by Circuit Judge *Denison* in deciding the *Firestone* case (Pet. for Cert. p. 34); it does not seem

necessary to determine that question in the present case, for the reason that the exact association of mechanical elements, whether it be aggregation or combination, was present in the prior practice of hand spinning tires.

At any event, the prior practice shown by all the witnesses who have testified on this point, and admitted by State the patentee, completely anticipates the *method*, and the *mode of operation* of the machine of the State patent; including the initial *longitudinal stretching* of the fabric, the *application* of the same *around the tread portion* of a core, the *rapid rotation* of the core, the *spinning down* of the fabric on the sides of the core *gradually* by radially moving spinning rolls *pressed against* the sides of the core, and the *action of centrifugal force* to throw out the unattached skirts of the fabric from the sides of the core to *frictionally engage* around the edges of the spinning rolls and be *radially stretched* thereby.

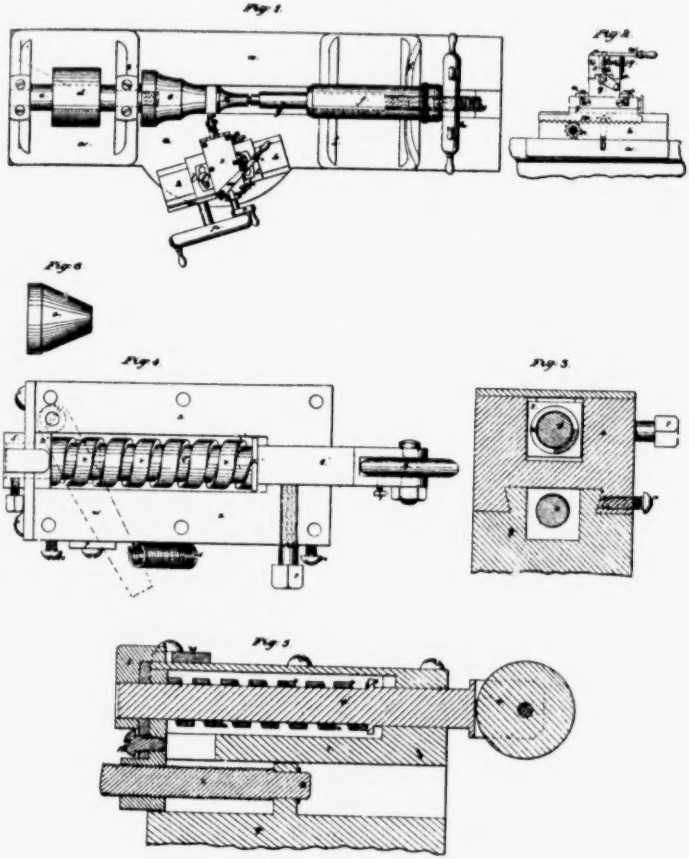
PRIOR PATENTS.

Although the quasi manual method of building automobile tires was well known and in common practice before a more mechanical apparatus was developed for performing the same process; the same methods, in all substantial respects, had long been used in the work of spinning metal sheets and bicycle tires, by apparatus having the same association of mechanical parts and the same modes of operation, in every substantial respect.

Among the representative prior patents appearing in the record, are three machine or apparatus patents for spinning metal sheets; and a reading of these patents shows that they disclose associated devices for performing the same functions by the same means and by the same methods, which were subsequently employed for building automobile tires.

The early Seymour patent, No. 80,836 of August 11, 1868, for an Improvement in Machinery for Spinning or Burnishing Articles of Sheet Metal, explains the objects and purposes of the patented invention, as follows:

> "Machines have heretofore been made for operating upon disks of sheet metal, to spin them up to the shape of a chuck or former, the said chuck or former and the sheet metal *revolving against a roller* that is held to said sheet metal by a *slide-rest*, to which motion is given to cause the roller to *move along* the surface of the chuck or former, as may be seen in the French patent of Japy Brothers, dated March 1, 1836.
>
> "The nature of my said invention consists in mechanism for holding a roll or burnisher with a *yielding* or *elastic* power against the *revolving sheet metal and former*, so that the spinning up of articles of sheet metal can be done with a tool that is held by mechanism that will *yield to the curvatures* of the former or chuck, and operate *similarly to the spinning of sheet-metal articles by hand.*
>
> "By my mechanism, irregular shapes, such as used for lamps, oil-cans, etc., can be spun up with great speed and precision by a workman with but little experience or bodily strength, while the spinning of large articles of sheet metal has heretofore required a workman with considerable experience and bodily strength to hold the tool.



Early Seymour Patent No. 80,836 (II-324).

"My improvements are adapted to spinning up of regular conical articles in sheet metal, but are more particularly available in spinning up ornamental articles formed with curved sides or angular bends, forming bands or varying shaped circular articles, *now spun up by hand* or pressed up in dies."

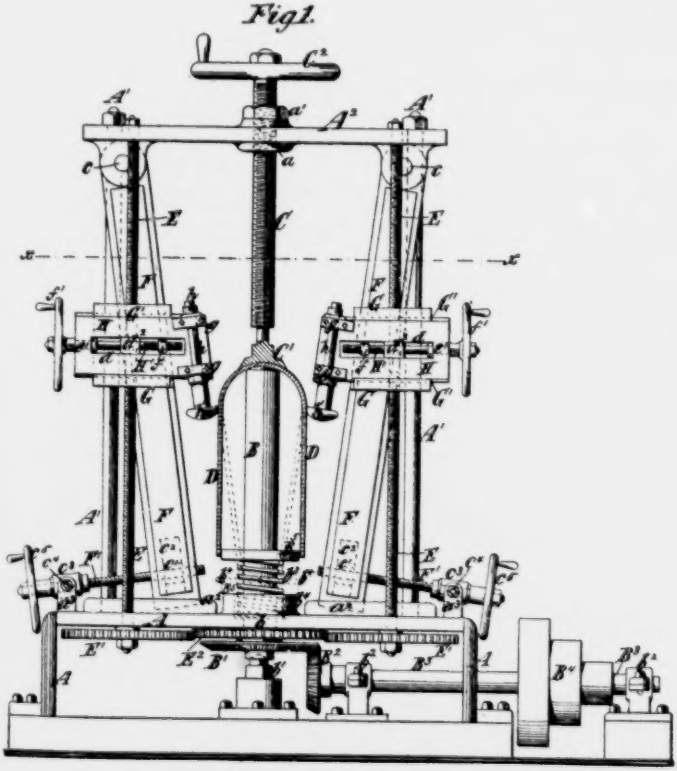
"By the apparatus constructed as aforesaid, the *workman is relieved from the labor of holding the tool while the spinning operation is performed,* and he is able to guide and direct his tool with precision, in a manner corresponding generally to that employed in turning metals with a slide-rest; and, in addition to the *yielding* force applied to the tool, to cause it to conform to the shape of the chuck or former, the screw *r* and hand-wheel *p* place the tool under the direction of the attendant, and if the spring *v* is too powerful for any particular character of work, its force may be lessened by the hand acting to draw back the lever *w*" (II-325, 6).

This first Seymour patent recognizes an earlier practice of spinning sheet metal articles by hand, and as clearly shown in the drawings and described in the specification, the quasi mechanical apparatus set forth in the patent embodies a *power driven, revolving mandrel,* and a *cooperating spinning roller mechanically mounted for moving along the mandrel at a retreating angle from the direction of its movement, and with a yielding pressure against the surface thereof;* and it may be asked at this point—What more does the State patent set forth, with respect to the association and mode of operation of the spinning roll and revolving core?

As the machine or apparatus of this patent operates upon disks of sheet metal, forming regular conical articles or ornamental articles with curved sides, it is evident that there must be a *radial elongation or displacement* of the metal in the disk corresponding to the

circumferential contraction of the same necessary to form the reduced diameter of the sides of the article; just as there is said to be a *radial stretch* and *longitudinal constriction of the edge of the fabric in an automobile tire.*

The later Seymour patent, No. 376,167 of January 10, 1888, for Improvement in Machines for Shaping Wrought-Metal Cylinders or Shells, describes the machine, which is well illustrated in the drawing, as follows:



Later Seymour Patent No. 376,167 (II-328).

"This machine comprises a base portion or bed-plate, upon which are erected columns or posts, and a head or top plate surmounting such columns or posts. It also has a central *rotary mandrel* or spindle, upon which the cylinder to be operated upon is placed, and a rotary and screw-actuated steadiment, which may be brought down upon the closed end of the cylinder to hold it upon the mandrel or spindle. By the rotation of the mandrel or spindle the cylindric shell to be operated upon, whether in a *heated* or cold state, is turned or rotated. At opposite sides of the central mandrel or spindle are two carriages, each containing a *slide having mounted upon it a rotary spinning wheel* or tool, and by means of vertical *feed-screws* these carriages and their slides and tools are moved upward and downward or traversed along the cylinder.

"The two carriages are mounted upon slideways or guides, which may be pivoted at one end, as at the top, and adjustable by means of adjusting-screws toward and from the central mandrel or spindle at their lower ends. As the carriages and their slides and tools are traversed up or down by the feed-screws, they will follow the direction of these slideways or guide-bars, and if the slideways or guide-bars are set with an inward inclination toward the central mandrel or spindle the carriages and their slides and tools as they traverse downward will be gradually moved inward toward the mandrel or spindle, and will thereby impart to the cylindric shell operated upon a *downward-tapering form*, such as would be required for the air-chamber of a pump.

"By means of the adjusting screws, which are at the lower end of the guide-bars, they may be set inward or outward relatively to the central mandrel or spindle, so that the *spinning tools* or wheels will be moved downward in lines parallel with the mandrel or spindle for producing straight work, or in lines more or less inclined relatively to the central

axis for producing a downward taper or downwardly-flaring work" (II-331).

This second Seymour patent shows quasi mechanical apparatus including the same associated mechanical elements as the early Seymour patent, in which all the movements of the spinning roll with reference to the work, are *mechanically controlled*, with means for *manually adjusting* the pressure and movement of the spinning rolls to and from the work.

The patentee also states that "*The cylindric shell D may be operated upon by my improved machine either in a hot or cold state*" (II-333); and this statement seems to imply a *displacement* of the metal by the action of the spinning rolls, to produce a *stretching or elongation* of the sheet in a direction normal to that in which it is *circumferentially contracted* by the advancing operation of the spinning rolls.

The Dewey patent, No. 438,407 of October 14, 1890, for Improvements in Apparatus for Forming or Shaping Sheet Metal Electrically, illustrates and describes a similar association of the same mechanical elements for operating upon a sheet metal disk by passing a heating current of electricity through it, while a spinning roll cooperates with a revolving mold to form the disk into a cup shaped ring. The patentee describes the method employed and the mode of operation of his apparatus, as follows:

> "My invention relates to certain apparatus for use in my process or method of forming sheet-metal articles which requires the employment of heat to soften or anneal the metal, and the application of pressure to gradually conform the sheet to the surface of a suitable die or mold.

"The process depends for its success upon the *malleability* of the metal; and it is the purpose of my invention to keep the metal annealed or in a softened condition during a greater part of if not the entire or complete formation of the article and to decrease the number of molds as well as the number of pressings usually required in forming or shaping the article, and also to save time and handling.

"The *pressure-instrument* D is held upon the lathe-rest *d* as a fulcrum, and while the disk A and mold C are *revolved* said instrument is applied to the disk near the center, which is rapidly bent or swaged, so as to fit close against the curved face of the mold. The instrument D may be held and moved by any suitable means, but preferably in the hand and by the handle *d'*. A gentle pressure is caused to bear on one point, thus producing a slight depression; but as the sheet is spinning at high velocity the depression at once forms a circle, and so by continuing the pressure of the instrument and gradually moving the same the sheet is molded into any form accordingly.

"Various forms of pressure instruments or burnishers may be used, the one shown in Fig. 3 being *provided with a roll d''* to decrease the friction between the bearing points."

"It will be also apparent that the sheet of metal may be by this method maintained in a heated, softened, or annealed condition during the entire formation of the article, if desired, and that with suitable current-regulating devices in circuit the sheet may be kept at any temperature desired without danger of burning or heating the sheet metal too much" (II-321,2).

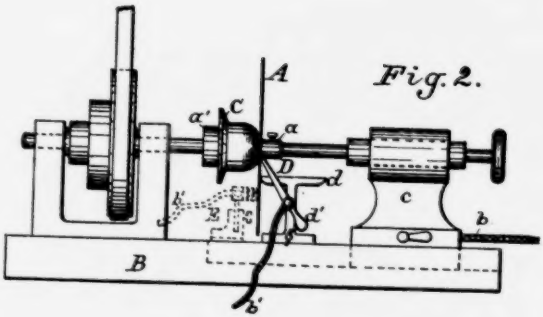


Fig. 2.



Fig. 1.

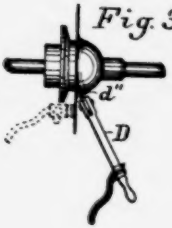


Fig. 3.



Fig. 4.



Fig. 5



Fig. 6.



Fig. 7.

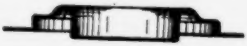


Fig. 8.

Dewey Patent No. 438,407 (II-320).

No functional difference is seen between the *radial displacement, stretching* or *elongation* of the malleable metal, which is necessarily required to cause the *circumferential contraction* thereof in the formation of a cup shaped article from a flat disk; as compared with the like *radial displacement, stretching* or *elongation* of the rubber saturated fabric which may be required to cause a *circumferential contraction* thereof in the formation of a tubular tire from a cylindric strip of fabric.

This conclusion is supported by the testimony of plaintiff's expert, Arthur S. Brown, as follows:

> "In metal spinning, the metal is made to *flow*. That is to say, the metal is *displaced* from one position to another. The metal cannot be changed greatly in shape except at several stages between which the metal has to be heated, or else the metal has to be maintained hot" (I-494).

In the same sense, it is believed that as far as the function of a method or a machine is concerned, the rubberized fabric is made to *flow*, and is *displaced* from one position to another; not by a heating thereof as may be required for a metal, but by the inherent *elastic* or *ductile* character of the material.

The Moore patent, No. 518,112 of April 10, 1894, for Improvements in Machines for Making Shoes or Covers for Pneumatic Tires, illustrates and describes an application or adaptation of substantially the same method and

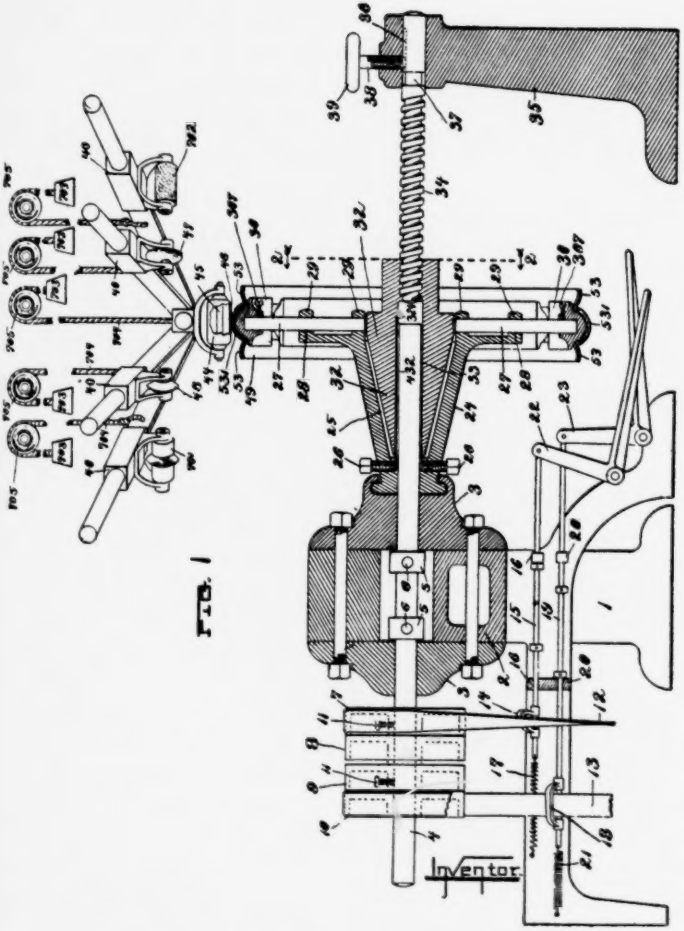


FIG. 1

Moore Patent No. 518,112 (II-274).

mode of mechanical operations in the manufacture of bicycle tires; in which a ring shell is employed as a form for the fabric, the same being mounted upon an expanding spider for *stretching* the fabric, and is provided with power driven mechanism for rotating the core-shell at a *high rate of speed*, while disk-like rollers mounted on levers are manually applied to the fabric for the purpose of smoothing and stretching the same into proper position and condition.

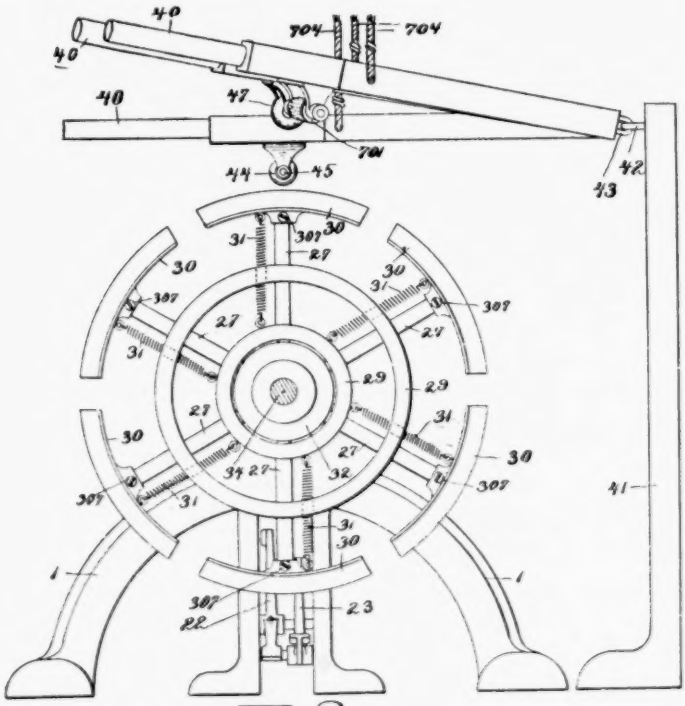
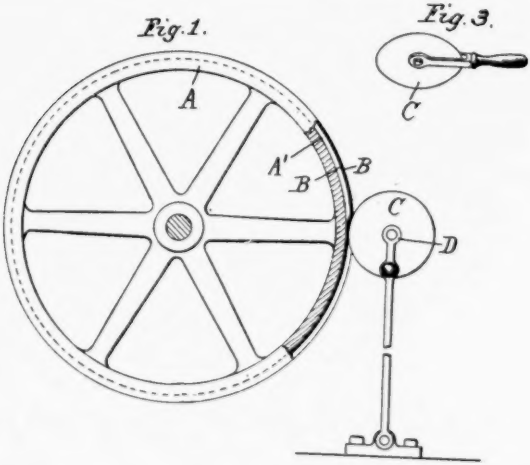


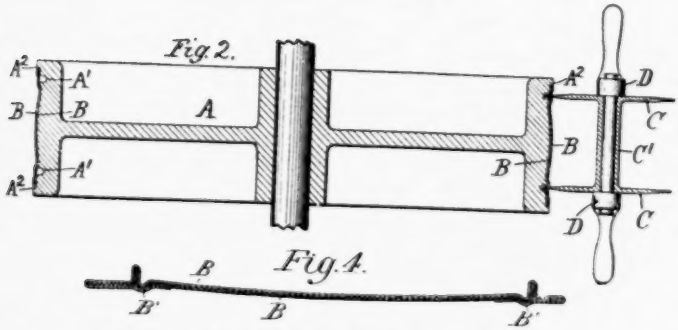
FIG. 2.

Moore Patent No. 518,112 (II-276).

A mere inspection of the drawings of this patent is sufficient to show that as far as function or mode of operation is concerned, the machine or apparatus is a mere adaptation of the method and mode of operation disclosed in the prior metal-spinning patents.

The Jeffery patent, No. 607,245 of July 12, 1898, for Improvements in Pneumatic Tires and Processes of Making the Same, shows a further adaptation of metal spinning methods in the manufacture of pnuematic tires;





Jeffery Patent No. 602,245, (II-286).

and it is particularly interesting, because it illustrates in the same drawing a *manual* and also a *quasi mechanical* use of a disk-shaped roller, which is elsewhere throughout the record referred to as a "*spinning wheel,*" and sometimes as a "*stitching wheel.*"

The Seiberling and Stevens patent, No. 762,561 of June 14, 1904, for a Machine for Making Outer Casings for Double Tube Tires, illustrates and describes associated mechanisms for building automobile tires of exactly the same construction which is said to be the purpose of the State patent.

The pertinent parts of the Seiberling and Stevens machine are well set forth in Figs. 1, 4 and 6 of the drawings, and nothing need be added to the concise description which is contained in the opinion by Circuit Judge *Denison* of the Court of Appeals for the Sixth Circuit, in deciding *Firestone vs. Seiberling* (Pet. for Cert. pp. 24, 25), as follows:

> "The Seiberling and Stevens patent seems to disclose a machine for doing this work automatically, instead of manually. The machine comprised (so far as now necessary to mention): First, a main *power driven* shaft which would indirectly engage and drive the core and with such selective connections that the core could be revolved at *low speed* or at *high speed,* or entirely released, as desired; second, a reel carrying the rubber-impregnated fabric strip; third, a tension roller retarding the reel, and thus causing the central tread strip of the fabric to be given a *continuing* stretch after the free end is attached to the core; fourth, a presure roller or cylinder concaved on its exterior to match the shape of the tread of the core, whereby the tread portion of the strip was pressed upon and attached to the core as the latter revolved; fifth, an arm carrying,

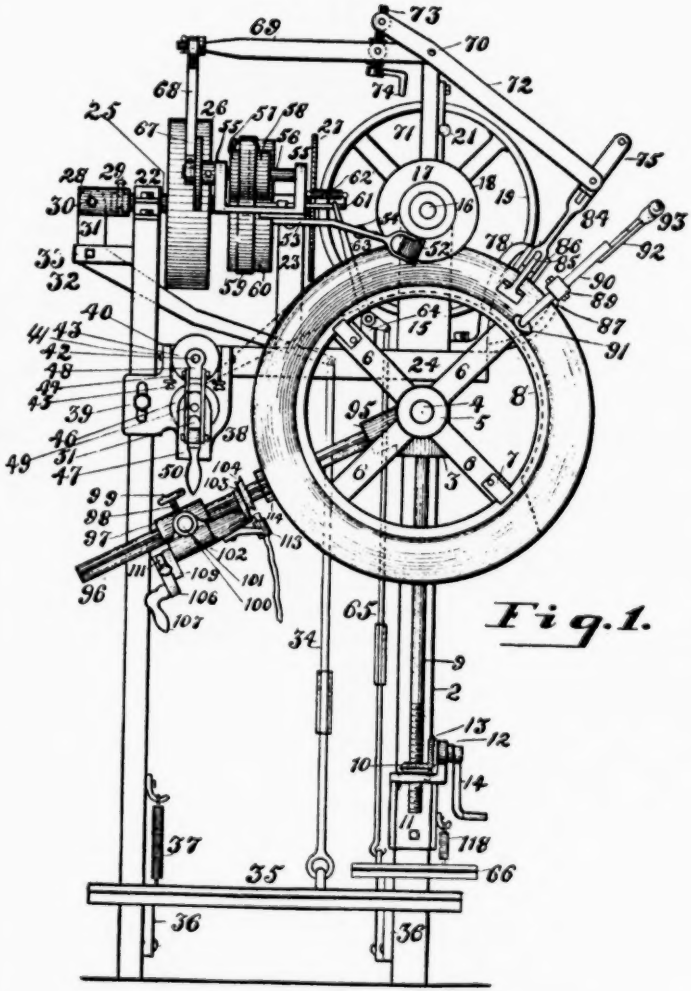


Fig. 1.

Seiberling and Stevens Patent No. 762,561 (II-257).

at its end, a laterally spring-pressed finger—'the jigger finger,' and which arm was intended to be reciprocated rapidly, radially of the core, in such a way that the finger traveled in and out radially, pressing against the side of the core as the latter revolved, and which pressure finger therefore traveled a saw-tooth course between the edge of the stretched, central, tread portion of the fabric and its final outer edge, and corresponded in function to the human finger pressing the fabric down against the core and stretching it into shape; sixth, a further arm containing a further *pressure wheel* to be applied along the edge of the attached fabric, after it was attached, to press it into a crease, constituting 'stitching.'"

The smoothing fingers 85 shown in Figs. 1 and 6 of this patent correspond in form and function to the *reciprocating paddles* referred to by witnesses in describing the so-called "*stitching method*" employed in building a tire by hand; and the sharp-edged rollers 91 shown in Figs. 1 and 4 of this patent correspond in form at least with the *spinning* or *stitching rolls* referred to by the same witnesses in describing the "*spinning method*" employed in building a tire by hand.

Under these circumstances, and in view of the early recognition in the Dewey patent of 1890 of the availability of either a *pressure paddle* or a *spinning wheel* for shaping a sheet upon a rapidly rotating form, and the common practice of so doing in the building of tires by hand; no invention would seem to be required to provide the *smoothing paddles* 85 with the *juxtaposed stitching rolls* 91 in the Seiberling and Stevens patent, and in radially reciprocating the same slowly enough to spin a fabric upon the core, if it were desired to do so.

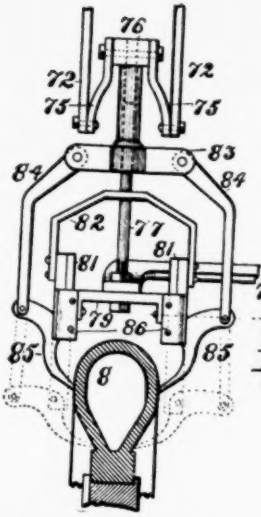


Fig. 6.

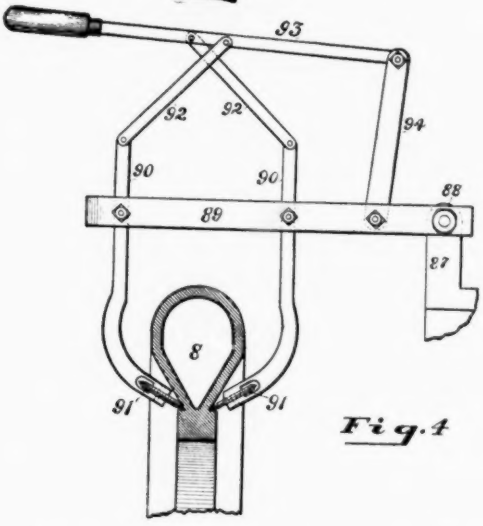


Fig. 4

Seiberling and Stevens Patent No. 762,561 (II-257).

The Vincent patent, No. 794,473 of July 11, 1905, illustrates and describes a machine for building tires, in many respects substantially the same as the machine of the State patent, including a power driven ring core, a stock roll or fabric supply and means for tensioning the fabric.

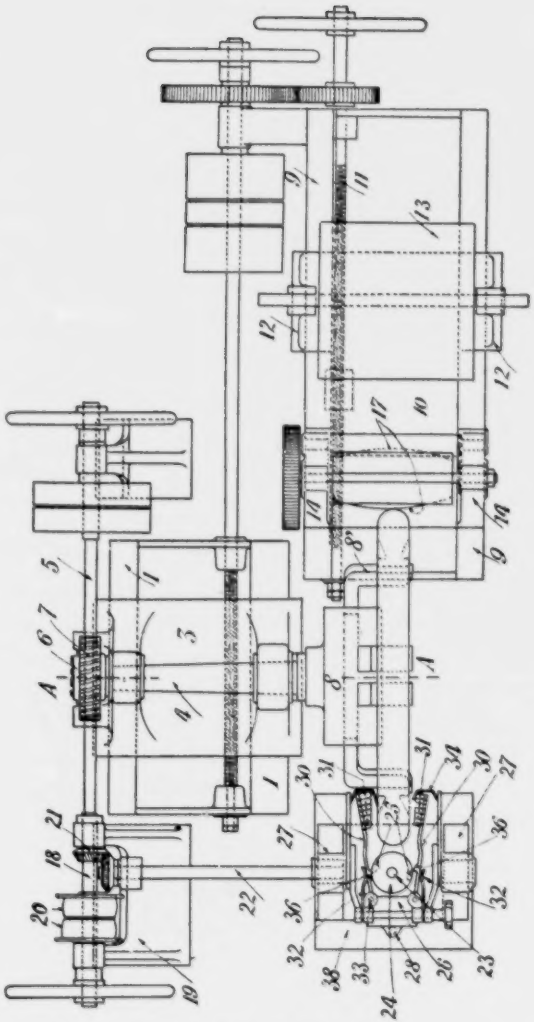
Although the machine of the Vincent patent may be intended more particularly for carrying out the so-called "single stretch" method, the testimony of Mell shows that when even an 18 or 20 per cent stretch or elongation is given to the fabric, it never lies on the core in correct position, and it is always necessary to place the fabric in its proper position by other means.

The machine of the Vincent patent was certainly a commercially successful machine, as evidenced by the report made in 1907 from Milan, Italy, by the plaintiff to his brother, that a Vincent machine was being there used to make four tires per hour, by a manufacturer who said that "*It works perfectly putting the fabric on at uniform tension*" (I-402); and as also shown by the testimony of *Harry K. Raymond*, of Akron, Ohio, Second Vice-President, in charge of production of The B. F. Goodrich Company, where a Vincent machine was used in about December, 1906, for a period of some eight months or possibly a year, "*In making between seventeen or eighteen thousand*" tires, which were "*commercial*" and were "*sold*," and upon which *royalties* were paid (I-187, 8).

Upon cross examination, Mr. Raymond testified as follows:

> "XQ. 16. Did the machine operate satisfactorily with you?
>
> "A. It did.
>
> "XQ. 17. Entirely satisfactorily?
>
> "A. At that period of time, yes.

FIG. 2.



Vincent Patent No. 794,473.

"XQ. 18. You mean the tire standard was not, perhaps quite so exacting then as later on?

"A. Not at all that. I mean that machine was at that period a *perfectly satisfactory machine.* It was developed to produce more tires, at a less cost.

"XQ. 19. Were the tires of as good quality?

"A. They were.

"XQ. 20. Did you have any difficulty in the cam mechanism that operated the hammers, that you recall?

"A. No material difficulty, no.

"XQ. 21. But there were some imperfections in that action, were there not?

"A. I shouldn't say so. I don't think there was anything mechanical that couldn't have been cared for.

"XQ. 22. Were the original stretching devices for the fabric satisfactory in their mode of operation, as you recall it?

"A. I think so. *They made perfectly good tires*" (I-188, 9).

Raymond testified further that the percentage of circumferential stretch secured in the original Vincent machine was approximately about eighteen per cent, and proceeded to say that—

> "I think, Mr. Rogers, that the amount of stretch and the shape of the fabric on the Vincent machine conformed very closely to what is considered good practice to-day" (I-190).

Thus the Vincent machine, following the disclosure of the Seiberling and Stevens patent, left very little if any room in the rapidly narrowing field, to be occupied by subsequent inventors, having in mind the crowded state of the art shown by the prior practice and prior patents which have been reviewed.

MATHERN BELGIAN PATENT NO. 194,731.

September 20, 1906 (II-217).

The Mathern Belgian patent was granted during the year before State began his experiments, and seems to show everything which State has claimed, or could claim, in his subsequent patent No. 941,962 (I-1).

Copies of eighteen photographs, comprising Defendant's Exhibit D (I-162), illustrating a machine made and used under the Mathern German patent No. 206,-197, applied for December 20, 1906 (II-305), modified to include the rounded roller tools shown in Fig. 6 of the Belgian patent, together with reproductions of the drawings in the Mathern Belgian and German patents, are appended as a part of this brief, and reference is made to them in the following discussion.

Plaintiff's expert witness, Arthur S. Browne, has very fully and correctly described the machine of the Belgian patent, in setting forth the characteristics of the State machine for another purpose, as follows:

> "There is a rotating power driven ring-core. There is a low speed mechanism, a high speed mechanism, and speed changing mechanism, so that the ring-core may be power driven both at low speed and at high speed.
>
> "There is a stock roll for the unformed flat sheet fabric and tension mechanism between the stock roll and the ring-core, so that the sheet fabric can be uniformly stretched circumferentially when applied to the ring-core.
>
> "There are two forming- or spinning-rolls which simultaneously act upon the opposite sides of the ring-core and against the hinges of the sides of the fabric where the unattached portions join the attached portions.

"Each forming or spinning roll is carried by a swinging arm and is forcibly pressed against the fabric upon the core. (Mathern) gets this pressure by (manual) means * * *, and while the State patent shows a spring for this purpose, it specifically says that (manual means) may be used.

"The spinning rolls are mounted upon a sliding carriage. This sliding carriage is mechanically mounted and accurately guided upon the machine so as to move radially with respect to the ring-core.

"The sliding carriage is fed by a screw so that it is gradually and progressively advanced as the forming- or spinning-rolls press against the rapidly rotating ring-core.

"Each spinning-roll has a rounded working edge.

"Each spinning-roll is set at a receding angle with respect to the ring-core" (I-44, 5).

It is true that this analysis was made to apply to the Defendant's machine, but as it so clearly applies to the Mathern machine without any modification whatever, excepting only the substitution of the name "Mathern" for "Defendant," and of "manual means" for "a weight," both of which are within the specified scope of the State patent; no argument seems necessary to arrive at the conclusion that the Mathern patent completely anticipates the *machine* of the State patent, and this fact is necessarily implied from the disclaimer which has been filed in the Patent Office (I-9).

Plaintiff's disclaimer is obviously intended to avoid the effect of the existence of the prior Belgian patent, by pointing out certain things which it is said cannot be done by the use of the machine illustrated and described therein; in the face of the fact that few, if any, of these things are described or claimed in the State patent.

While it may not be fatal to the validity of the State patent, that it does not disclose or describe the manner in which it may *be operated* as outlined in the disclaimer, if the same is inherent in the machine which is set forth in the patent; it is no more fatal to the anticipating effect of the Belgian patent, that it does not disclose or describe the manner in which it may likewise be operated, if the same is inherent in the machine which is set forth in the patent. Obviously both patents must be interpreted by the same rule.

Plaintiff's Assumed Theory.

The disclaimer is based primarily upon an *assumed theory* that there is something inherent in the *"Slight uniform puckering of the fabric strips at their edges,"* normally produced by the Mathern machine, which is said to prevent the same from being applied to the sides of the core in the manner which is alleged to be inherent, although not set forth, in the State patent; and it is interesting, if not important, to consider what the record shows on this subject.

Plaintiff has sought to support this theory by the use in briefs below of an arbitrary or fanciful sketch, purporting to show the result of the slight crimping of the edges of the fabric by Mathern's beveled gears 36; and by the testimony of its expert Browne, as follows:

> "The described combined effect of the rolls 26 and gears 36 is to pre-form the fabric by stretching it at its middle and gathering it at its sides.
>
> "This pre-forming of the fabric would facilitate the subsequent sticking of it to the core, since it would be partly conformed to the shape of the core, and this is what Mathern specifies in his second claim as the purpose of this pre-formation" (I-462).

Aside from the slight crimping of the edges of the fabric, there is nothing materially different in the "preforming" of the fabric, by Mathern's longitudinal stretching operation, compared with State's corresponding stretching operation. In the Mathern machine, the fabric is passed over a spherical roller which stretches the median line of the fabric without stretching the lateral portions thereof, just the same as the median line of the fabric is stretched directly by the core of the State machine, without holding the lateral portions thereof to the stretch previously given thereto, which permits their elasticity to contract them to normal length at the sides of the core. This condition is clearly shown in Photographs Mathern Machine No. 6, *infra*, as compared with Fig. 2 of the State patent, on the opposite page.

In both cases the result is exactly the same when the fabric is initially applied to the core, the median portion of the fabric hugs around the tread portion of the core while the lateral portions of the fabric hang free of the sides of the core. This fact is conclusively shown by a mere inspection of the Plaintiff's Exhibit No. 35, Photographs State Machine (No. 1) (11-189), and of Defendant's Exhibit D—Photographs Mathern Machine (No. 7) *infra*. The latter picture shows that there is quite as much "bagging" of skirts of the fabric at the side of the tire in the Mathern machine as there is in the State machine, and that the slight crimping of the edges does not appreciably affect the position of the free fabric at the sides of the core.

There is no foundation whatever in the record for the sketch used in plaintiff's briefs, showing a tubular formation of the fabric with its crimped edges uniformly curved inward so as to initially embrace the sides of the core; and the impertinence of this sketch is evidenced by

the same Mathern picture, No. 7, which shows that the skirts of the core hang indifferently, and mostly swing outward away from the core, and do not embrace it as implied in the sketch referred to. Thus the *crimping* of the edges of the fabric is not a *pre-formation* thereof which materially affects the application of the fabric to the sides of the core.

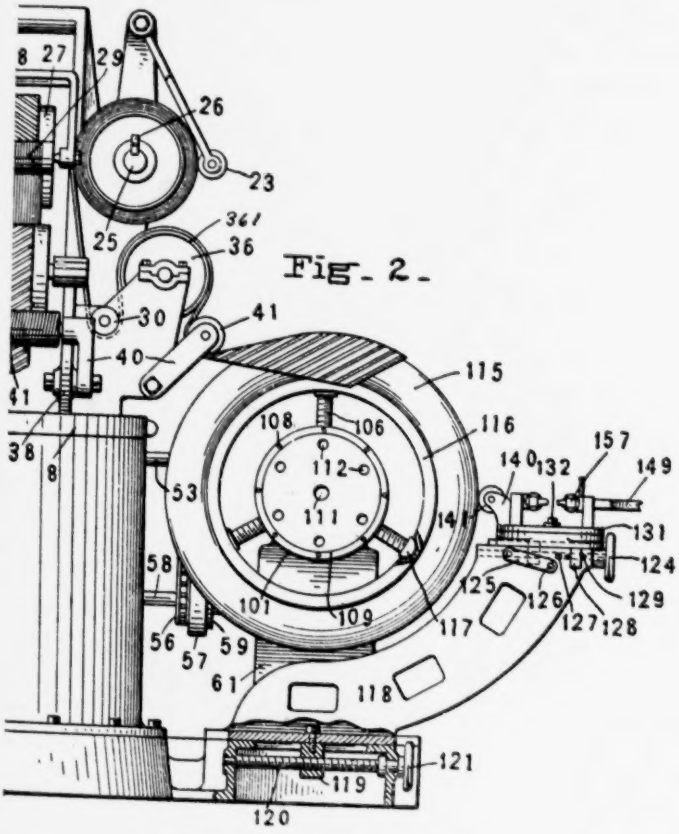


Fig. 2.

State Patent No. 941,962.

Plaintiff further seeks to support the assumed theory, by urging that even though the lateral wings of the fabric are not formed and cemented to the sides of the core by the *initial stretching* application thereto, they *are so* applied and cemented to the core by action of Mathern's reciprocating rolls 30,—thus leaving no work for Mathern's spinning rolls, Fig. 6, to do, but to remove or eliminate the puckers or wrinkles *after* the fabric has been applied and cemented to the core, thereby preventing an operation on the skirts of the fabric when they are free.

Plaintiff's expert Browne is very careful not to testify directly that the reciprocating rolls 30 operate *all the way down* to the base of the core, but does so indirectly in describing the operation of the rollers, Fig. 6, as follows:

> "The function of the rolls 30, therefore, is to stick the fabric to *the straight or convex sides of the core* * that is to say, against the sides of the core whatever the shape may be, thereby cementing the sides of the fabric to the sides of the core" (I-463).
>
> "Thus, as the rolls 30 reciprocate back and forth in a direction which is radial with respect to the core, they bear on the sides of the fabric, pressing it against the core, and as a result the fabric is cemented to the core on its sides" (I-463,4).
>
> "The result of these actions up to this point is to lay and apply the fabric onto the core with wrinkles, folds, or puckers in it. Puckers, creases, or wrinkles have been intentionally made at the sides of the fabric by the conical gears 36 and wrinkles may exist in other portions of the fabric—inevitably so, if the spherical pre-forming rolls 26 shown in the drawings are employed" (I-464, 5).
>
> "Accordingly, Mathern then proceeds to remove the puckers or wrinkles from the fabric by the em-

* Emphasis Brown's.

ployment of the tool shown in Fig. 6, or by employing two of such tools at the same time at opposite sides of the core" (I-465).

"Thus the action of these rollers of the tools of Fig. 6, when two are employed simultaneously, is over the entire surface of the fabric, from the top of the core down to its base. Hence, wherever any puckers or wrinkles are located in the fabric, it is the intent of Mathern to remove them all by this comprehensive action of these tools" (I-465).

"The sole office of the rollers of Fig. 6 which is mentioned in the Mathern specification is the removal or elimination of puckers or wrinkles which are present in the fabric *after it has been applied and cemented to the core*" (I-466).

The conclusion thus arrived at in the foregoing discussion, is not justified either by the plain language of the Mathern patent, or by an actual operation of the machine of the patent which is illustrated and described in the record.

In the first place, the Mathern patents describe the operation of the rollers 30 as follows:

"Each of these rods carries at its extremity a roller 30, which advances and retracts on the core so as to stick to its *straight or convex* sides the fabric which has just been placed there" (II-220).

The juxtaposition of the words "straight" and "convex" is sufficient to show that both words are intended to refer to the *side portions of the core* as distinguished from the tread or base portions thereof; especially in view of the fact that the art at that time included cores which were either flattened or rounded on each side.

This fact is impressively shown by the disclosure of various figures in the Seiberling and Stevens patent

No. 762,561 (II-257), in which both kinds of cores are shown, and particularly in Fig. 5 of that patent, which illustrates a core with flat or "*straight*" sides as follows:

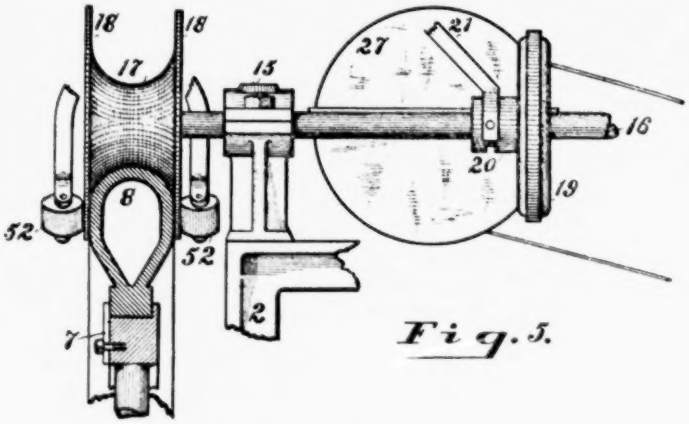


Fig. 5.

Seiberling and Stevens Patent No. 762,561 (II-257).

This illustration is also very impressive in showing the use of rolls 52 in cooperation with the disk flanges 18 on a tread roller 17, for pressing the fabric against the straight sides of the core, which is obviously the *sole* purpose for which the rollers 30 are to be employed in the machine of the Belgian patent; and which is the manner in which they are actually employed in the machine of Mathern's contemporaneous German patent, as well shown in Defendant's Exhibt D—Photographs Mathern Machine (Nos. 8 and 9) *infra*, with reference to a core having round or "convex" sides.

This conclusion is confirmed by the language employed by Mathern in describing the operation of his Fig. 6 spinning rolls, as follows:

"Then the machine is set in operation and the roller is caused to descend progressively *on the side* of the core and *all the way down to its base*" (II-220).

There can be no mistake as to the meaning of this language, which occurs in the same paragraph of the Belgian patent in which the operation of the roller 30 is described by language which specifies only a particular portion of the sides, to-wit; the "*straight or convex*" portions thereof; so that Mathern's meaning is clearly conveyed by the use of language which cannot be mistaken.

And finally, it would be impossible to use a spinning roll to remove the wrinkles or puckers which have been produced by the crimping rolls in its edges, *after* they have been applied and cemented to the base sides of the core; or even to remove wrinkles which may exist in other portions of the fabric on the straight or convex sides of the core in the manner suggested by plaintiff's expert; for the reason that the testimony of practical men experienced in the art is that such wrinkles can only be removed by lifting the fabric from adhesion to the tire and smoothing it thereupon by the reciprocating use of a stitcher or a spade, as follows:

"The only time that a saw-tooth movement of a stitcher or a spading tool need be used is when a wrinkle develops in the application by the spinning roll in the hand spinning which *necessitates lifting the fabric from the core* and straightening out the wrinkle" (Duncan I-199).

"So far as I remember, wrinkles or uneven places obtained in stitching a tire were smoothed out by paddle or stitcher" (Roe I-170).

These considerations seem to dispose of the contention that the fabric is *applied and cemented* to the base sides of the core, either by the initial stretching opera-

tion, or by the action of the rolls 30 in the machine of the Mathern Belgian patent.

The same conclusion is clearly confirmed by further language of the Belgian patent, when read in the light of the meaning which is given to the terms employed therein, by the experienced tire builders whose testimony has been quoted at length in this brief.

Immediately following the description of the roller 30 and the roller Fig. 6 mechanisms, and the manner in which they operate, Mathern goes on to says that—

> "After the fabric has been thus *laid down by these devices*, the same operation is repeated in *laying down* the several fabric strips on which the beads are applied; then after the beads have been put on, the other fabric strips are *laid down* before covering and enclosing the beads. The *laying down* of these other fabric strips is accomplished in the same manner by means of the rollers 30 *and the roller tools like that shown in Fig. 6*" (II-221).

The expressions "laid down" and "laying down" are believed to describe the operation of *applying* and *cementing* the fabric to the core; that being the meaning of the same or similar expression used by each and all the experienced witnesses who have described the hand method of spinning tires.

In speaking of the operation of the hand spinning of the tires, Duncan said he "Would gradually move it *down* * * * until the fabric was completely *applied*" (I-194); Mell said that the fabric "Was rolled *down*" (I-153), and that it was "Worked *down*" (1-155); Koplin said they would "Stitch it *down*" (I-93); Drach said it was "Spun *down*" (I-102); Derry said they would "Spin it *down*" (I-108); Heller said he would "Spin it right *down*" (I-116); Stark speaks of "Running the ply *down*" (I-126); Green said he would "Stitch it *down*" (I-137); Gregg said he "Stitched it *down*" (I-148); Roe said it

was common practice "To stitch them *down*" (I-171); Bittaker said "The fabric was stitched *down*" (I-175); Curtis said they "Rolled it *down*" (I-294); Walch speaks of getting "Both sides *down*" (I-292); and finally, plaintiff's practical witness Mackey said they "Rolled the fabric *down* on the side of the core by a stitcher held in the hand of the operator" (I-116).

Thus every single witness who has told about building tires from personal experience, has used the word "down" to describe the operation of *applying* and *cementing* the fabric to the side of the core by a stitching wheel or a spinning roll; and it is fair to presume that Mathern well knew the common meaning of the word *down* among men familiar with the particular art, and that when he speaks of *laying down the fabric* by means of rollers 30, and the roller tools like Fig. 6, he meant the operation of *applying* and *cementing* the fabric to the core, as distinguished from a mere removal of wrinkles.

This conclusion is not affected by the language employed by Mathern in particularly pointing out the principle of his invention in his description and claim with respect to the operation of the spinning rolls, as follows:

> "The control systems of the several mechanisms may differ from those described above, but the invention comprises the application to the manufacture of tires * * * (c) of the principle of the roller descending progressively on the core during rapid rotation and producing a *progressive removal from the fabric of the puckers by eliminating the puckers from the point of their origin*, this being performed in a single descending movement" (II-221).

> "4. In a machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a tool carrier having rollers and arranged to move downward automatically and progressively,

dependent on the rotation of the core, in order to *progressively efface the puckers of the successive strips of fabric* and to apply these strips on the beads, substantially as described and shown in the annexed drawing" (II-224).

In both of these statements, Mathern was no doubt endeavoring to *particularly point out* the essential characteristics of his *invention*, and distinguish the same from the things that were old and well known in the art, which was no doubt required by the Belgian law as it is by our Statute; and he was well advised in not including *broadly* in his principle and his claim, the operation of *"laying down"* the fabric on the core by means of his roller tools like Fig. 6, for he doubtless *knew that this principle and operation was well known and in common use in the art of spinning tires by hand*, before he devised his machine, and that *no one was entitled to a claim for the same.* For this reason Mathern could only *claim* the use of spinning rolls *"to progressively efface the puckers."*

This understanding is confirmed, rather than refuted, by the fact that in stating his claim for the rollers 30, Mathern specified the use of the same as being *"to stick the fabric on the sides of the core"* (I-224); which he was fully justified in doing for the reason that, as far as this record shows, he was the first inventor in this art to use rollers having a reciprocating movement perpendicular to the axis of the core, while rolling radially thereon in the manner of the Belgian machine.

The nearest mechanical approach to this idea is embodied in the stitching fingers 85 shown in the Seiberling and Stevens patent *supra;* and although it may not have involved invention to provide these fingers with the *old* hand stitching *disk* rolls traveling *along* the core,

if there *was* any invention involved in providing the same fingers with *cylindric* rolls traveling *across* the sides of the core, Mathern *was entitled to include and claim it as his invention.*

Thus the result is naturally reached that the rollers of Fig. 6 in the Belgian patent are intended by Mathern for "*laying down*" the fabric on the base sides of the core, from a position in which the wings of the fabric *stand free of the core;* as well illustrated in Photographs Mathern Machine, No. 9, *infra*, which shows the fabric on the core *after it has been acted upon by the rollers 30*, in position to be acted upon by the rollers of Fig. 6; and that in conjunction with the *old* spinning operation of "*laying down*" the fabric, Mathern's spinning rolls performed the additional function of "*progressively effacing the puckers.*"

Operation of Mathern's Spinning Rolls.

It does not seem necessary to discuss or determine whether Mathern's spinning rolls were intended to act on any portion of the *tread or top surface* of the fabric, as suggested by plaintiff's expert Browne (I-465); for the reason that if they do so operate, they merely perform a function which is attributed to the spinning rolls of the State patent, which are said by State in his patent to operate, as follows:

> "At first the spinning-rolls are positioned to act upon the edges of the tread portion of the tire-shoe" (I-21).

At any event the Belgian patent only specified that each Fig. 6 roll "*Is caused to descend progressively on the side of the core and all the way down to its base*" (II-220).

Plaintiff's expert Browne, however, seems to think that the spinning rolls of the Belgian patent are not mechanically fed and controlled in the same manner as they are fed or controlled in the State patent, as follows:

> "It is hence evident that by reason of its open hook embracing a pin 35, the tool of Fig. 6 is neither automatically nor positively fed downward.
>
> "For example, if the workman who has hold of the tool handle keeps the tool in a definite vertical position, the tool carrier slide will feed downwardly without imparting any feed at all to the tool and would ultimately feed down far enough to remove entirely the lateral pin 35 from the open hook of the tool. *The workman himself must perform the act of feeding the tool downward.* The only function of the slide 17 and its pin 35 with respect to the feed of the tool is that it prevents the workman feeding the tool down too fast. The tool cannot slip in the hands of the workman and go down too far. But the progressive and gradual radial advance of the tool, while limited by the tool carrier, *is due solely to the conscious act of the workman.* The workman, therefore, must feed the tool ahead at the same time that he is pressing its roller against the fabric, and is preventing the tool from being tilted in the plane of the core's rotation" (I-470, 1).

In giving this opinion Browne seems to have overlooked the testimony given by State himself, to the effect that the action of a spinning core is to *draw a spinning tool* applied to the sides thereof *inward toward the center* of the core, as follows:

> "Q. 129. And how did this system of advancing the slide 'M' work out in practice?
>
> "A. The tendency was to *lead in quickly,* and at times *was hard to hold.*
>
> "Q. 130. Why was it hard to hold?
>
> "A. From the tendency to *lead*—or for the rolls to *draw it in.*

"Q. 131. You mean that the *contact of the rolls* with the fabric on the core *tended to pull the slide in?*

"A. Yes.

"Q. 132. What was the reason for this tendency?

"A. In starting it on, *it seemed to take a screw movement in the rolls,* not advancing evenly on the side of the fabric; and, after they had started that way, they would continue.

"Q. 133. You mean that it was difficult for the operator to advance the slide toward the core regularly?

"A. Yes.

"Q. 134. Because the contact of the rolls with the side of the core *tended to pull the slide in?*

"A. It did.

"Q. 135. And, therefore, it was not easy to get a uniform advance of the rolls; is that correct?

"A. Yes.

"Q. 136. I next hand you, 'Sketch 8,' and ask you to point out the difference therein over 'Sketch 7^b.'

"A. Instead of operating the slide with a lever, it was operated with a screw and hand-wheel. In the hand-wheel you were able to change the position of the handle into different holes, so the operator could be able to change the speed of advancement.

"Q. 137. Now, did this device, particularly referring to the screw-feed of the slide, overcome the difficulty you have testified to in connection with 'Sketch 7^b,' as to which you stated that there was a tendency, because of the engagement of the rolls with the core, to draw the slide in by itself?

"A. It did.

"Q. 138. Just how and why was that tendency overcome in connection with the screw-feed?

"A. *The screw would not allow it to do it,* held it back.

"Q. 139. In other words, then, the screw had two functions: it enabled the operator to advance

and retract the slide at will, and, moreover, *resisted the tendency of the rolls to pull the slide in;* is that correct?

"A. Yes." (I-318, 19, 20)

Mathern evidently understood the tendency which State claims to have discovered, and depended upon the same to *draw the rolls inward* during the spinning operation; and as State testified that the tendency was so strong that it was hard to hold manually, it is evident that Browne was not well advised in testifying that the gradual radial advance of the spinning roll is *due solely* to the conscious act of the workman. As a matter of fact the spinning rolls are *automatically drawn inward,* when they are pressed against the side of the core.

Thus the "'*open hook*" connection of the Mathern spinning rolls with their support is sufficient to cause the rolls to operate in exactly the same manner that the State spinning rolls are said to act, because the *inward drawing* action resulting from their pressing contact with the core, tends to draw them inward just as fast as the screw feed will permit; the screw feed being employed by State as well as by Mathern, not to move the rolls inward while they are in action, *but to restrain too rapid an inward movement thereof.*

Therefore, if any invention was involved in providing a screw-fed sliding support for spinning rolls in a tire building machine, *Mathern anticipated State* in doing so.

Amount of Pressure Required.

Plaintiff's proofs do not sustain the position that the Belgian machine is ineffective for the work of properly building a tire, because its mechanically mounted and radially fed spinning rolls are not provided with springs to press them toward the core.

On the contrary, the record shows that a spring pressure is only useful for the purpose of constantly holding the spinning rolls against the side of the core, and to relieve the workman of a portion of the energy required in giving the full and varying pressure required, which is always supplied and controlled by the hands of the workman, in machine work as well as in hand work.

State candidly admits that tires can be well made if the stitcher arm is pressed in only by the strength of the operator and no spring used, as follows: "*You could have pressed it in hard enough to have made a tire that would have been all right * * * without the use of a spring*" (I-376); and tells why springs are not in themselves sufficient for the purpose, as follows:

> "The springs naturally—all the springs that were used naturally weren't as active as directly on the rolls when the core got narrower than when they were on the ball of the core, when *they would add a little pressure by the hand to it*" (I-377).
>
> "Along the tongue of the core, where it was thin, they *could help out the pressing on by spreading* (the stitcher arms) *with your hands*" (I-32).

And plaintiff's expert Browne admits that spring pressure is not uniform, as follows:

> "XQ. 78. You have referred to the spinning rolls 147 as being pressed inwardly by springs or by weights. If the said rolls are pressed inwardly by springs is it a fact that the pressure exerted by the said springs, and hence by the rolls, upon the fabric, *becomes less as the said rolls progress from the point of extreme width of the core toward the inner periphery of the core?*
>
> "A. Yes."

This testimony means that spring pressure becomes *weaker* as the spinning wheels approach the base of the

core where the *greatest pressure* must be applied to give the *increased radial stretch* required at the bead edge of the fabric; and that there is a like *lack of uniformity* in the pressure of springs which there may be in a purely manual pressure. In both cases, the required amount of pressure must be supplied or controlled *by the strength and will of the operator;* and many of the experienced tire builders have testified that their unaided strength is *fully adequate* for the work required.

Duncan points out that—

> "The amount of side pressure need be only sufficient to apply the fabric smoothly. The *adhesion* is obtained during the molding operation" (I-203).

Mell explains the molding operation as follows:

> "The tire was then *cured* in the usual manner, that all full molded tires are cured in" (I-154).

Koplin testified that the pressure in Firestone machines—"*Isn't any more than a man can use* * * * about 30 or 40 lbs." (I-198, 9) and Stark says "*I always got enough* on there to get them down where they should be" (I-128).

Walch testified that "*The hand made tire was considered just as good as far as durability goes as a machine made tire*" (I-288); and explained that the *amount of pressure* was not so important as it was to *hold the stitcher steady* as follows:

> "Well, it was not a *great pressure*—just enough to stick the fabric to the cement; there was some on the inside, just to touch the fabric, very little pressure * * * not to amount to anything; *you had to hold the stitcher steady;* that is the way you held it, the pressure, you didn't have to put on much pressure at all" (I-290).

It being shown that hand pressure is *fully adequate* in the use of spinning rolls for building tires, the Mathern patent discloses a machine which is *entirely effective* for the purpose intended; and if it is desirable to use springs to supplement manual control or pressure, the early Seymour patent No. 80,836, *supra, completely anticipates* State in the use of springs for the identical purpose.

Action of Centrifugal Force.

The machine of the Belgian patent is provided with clutches and gears for rotating the core alternately at high and low speeds. In describing the operation of the spinning rollers shown in Fig. 6, the patent specifies: *The principle of the roller descending progressively on the core during rapid rotation*" (II-221); and in claim 4 of the patent is specified "*A tool carrier having rollers and arranged to move downward automatically and progressively, dependent on the rotation of the core*" (II-224).

Furthermore Mathern's claim 4 refers back to his claim 1, which reads as follows:

> "In a machine for mechanically manufacturing casings for pneumatic tires, characterized by the fact that *several gears and clutches impart to an annular core various rotations appropriate to the phases of the manufacture* and enable the employment of special devices constituting part of the machine, substantially as described and shown in the annexed drawing" (II-223).

Thus the Belgian machine is provided with mechanical means for operating its core at a *slow speed* for stretching the middle or tread portion of a fabric, and for then operating it at a *fast speed* for spinning the fabric down upon the sides of the core, in *exactly the same manner* which is portrayed in the State patent.

Plaintiff's theory of the Belgian patent, seems to include a further assumption that the presence of slight uniform puckers in the fabric strips along their edges, serves to prevent these portions of the fabric from being thrown out by the rotation of the core in the same manner the corresponding portions of the fabric are thrown out by the rotation of a core in the hand method of building tires, and are said to be thrown out by the State machine.

This assumption is quite as gratuitous as the idea that the crimped edge portions of the fabric are intended to be and are attached to the corresponding sides of the core, either by the initial application of the stretched fabric or by the action of the reciprocating rolls 30; and no reason is seen why the unattached skirts will not be thrown outward by centrifugal force during the rapid operation of the Mathern core, just exactly the same as they are thrown out by a corresponding operation of the State core.

It is quite clear that such will be the action of the fabric when the spinning rolls are riding upon a portion thereof which has not been crimped, and it is only necessary to consider the action of the spinning rolls when they reach the crimped edge zone of the fabric.

The specification of the Belgian patent is not silent on this subject, for it expressly describes the principle of this particular operation of the machine as being—

> "The roller descending progressively on the core during rapid rotation and producing a progressing removal from the fabric of the puckers by eliminating the puckers *from the point of their origin*" (I-221).

This language can only mean one thing, and that is that Mathern's spinning rolls act upon the inner ends of

the slight uniform puckers to progressively eliminate them, just the same as State's spinning rolls operate on the inner ends of larger irregular puckers, to progressively eliminate the same.

The action of the spinning rolls produces a pressure line on the fabric in the path of its travel, along which line all the puckers in the fabric have been entirely eliminated and as the roller gradually progresses inward along its spiral course, this line continues to mark the inner ends of the puckers, which is the "*point of their origin*" referred to in the Mathern patent.

Furthermore, as the fabric is always laid smoothly along this line, it constitutes a hinge line upon which the outer unattached portion of the fabric may be thrown out by centrifugal force as readily as though it were not crimped with a slight uniform puckering.

An inspection of Defendant's Exhibit D—Pictures Mathern Machine, especially of pictures Nos. 9, 10, 11 and 12 *infra*, serves to show that such is and must be the operation of the machine of the Belgian patent; which is confirmed by pictures Nos. 12 and 17, which show the fabric to be smoothly applied, without any wrinkles, all the way down to the cutting line of the core.

In considering these pictures, it must be remembered that they are taken while the machine is not in motion, just the same as Plaintiff's Exhibit No. 35—Photographs State Machines, are taken while that machine is not in motion; so that in none of the pictures is the unattached skirt of the fabric shown to be thrown outward by centrifugal force as would be shown if motion pictures were taken of the respective machines.

Thus the machine of the Belgian patent can operate, and actually does operate in exactly the same manner as

the machine of the State patent; and if the identical operation produces a sufficient radial extension of the fabric to carry out the double stretch method of building tires in the one machine, it must necessarily produce at least as much radial stretch in the other machine.

That the Mathern machine of the Belgian patent, Defendant's Exhibit II (I-242), shown in Defendant's Exhibit D—Photographs Mathern Machine, *infra*, does so operate, is evidenced by the testimony of *John W. Thomas* that the machine was actually operated at the Firestone plant for making tires which were actually used on automobiles with satisfactory results (I-160); and by the testimony of *Guy L. Evans* that the machine was not only then used at the Firestone plant, but that he was one of the men who *operated that machine before the judges* of the Circuit Court of Appeals, at Cincinnati (I-165).

As a matter of fact, it would seem that the crimped zone in the edges of the fabric produced by the Mathern machine, might serve to *increase* the friction caused by the engagement of the outthrown skirts around the edges of the spinning wheels of the fabric, over that caused by the plainer skirts in the State machine; and to this extent, the operation of the Mathern machine would give a *better* result than that of the State machine, although the better result would be inclusive of the *lesser* result in its anticipating effect.

It may be noted that the Belgian patent says nothing about the action of centrifugal force and the radial stretch which are attributed by way of disclaimer, to be inherent in the State patent machine; and if this omission were a matter of consequence, it is just as true of the State patent, wherein the only reference to *cen-*

trifugal force is that it "tends to throw the fabric out at right angles from the core-plane and unless the roller recedes in the manner shown, *the fabric will become entangled with it*" (I-20)—no reference whatever being made to a *resulting radial stretch.*

This fact has caused Circuit Judge *Denison* to point out that "*Centrifugal force is not mentioned, in State's specification, save as creating an obstacle to be avoided*"; and it is quite as important to point out that the same obstacle was met and overcome in spinning down fabric by hand, not only by a 45° receding inclination of the stitching roll, but by the use of a roll having a larger diameter. Testimony to this effect was given by Duncan, as follows:

> "The fabric stood out at approximately right angles to the plane of the core. The roller was applied to the fabric on the core at approximately *an angle of forty-five degrees* to the plane of the core" (I-195).
>
> "A small wheel would have a tendency to *let the skirt of fabric catch the supporting yoke* and jerk it out of position. * * * The first wheels were about an inch in diameter but were almost *immediately increased* from two to two and a half inches. * * * The smaller ones were abandoned" (I-201).

It is more important, however, to point out that the state of the art shown by the prior practice testimony, gives the best explanation of the failure of both Mathern and State to describe the action of centrifugal force and the use of a radial stretch in the skirts of the fabric, when they are "*laid down*" on the sides of the core; is that this *action* and this *stretch* was so well known by the hand method workers, that no description of either the action or the stretch was *necessary* to enable men skilled

in the art to properly and successfully operate the respective machines.

The same thing is true of Mathern's failure to mention the numerical rate of the rapid rotation of the core required for the spinning process, which was *too well known* to require any description thereof; and State's guess on this subject, "*say at two hundred and seven times a minute*" (II-16), only confirms his testimony that in 1908 he *could not tell* within 50 revolutions the most desirable high speed for the core (I-375), and that he did not determine the high speed himself—and did not know who did (I-376).

State's guess was at least one hundred revolutions per minute and some 100% more than the speed of Goodyear commercial machines, in which the centrifugal force is utilized to good advantage, to-wit: "*somewhere between 80 r. p. m. and 120 r. p. m.*" as shown by the testimony of plaintiff's expert Browne, as follows:

> "XQ. 95. Then is it your understanding of the language I have quoted from the disclaimer that the unapplied fabric is thrown out to a position substantially at right angles to the plane of the core by centrifugal force?
>
> "A. I think this would be the case if the centrifugal force was being used to the best advantage. My observation is that the skirts are *thrown out at substantially right angles* to the plane of the core when a 34 x 4 core is rotating at about 80 r. p. m., but at that speed the skirts are not smooth, but still present waves or corrugations. These waves or corrugations disappear, however, at a higher speed, such as that employed in the Goodyear commercial machines and the centrifugal force is then utilized to good advantage.

"XQ. 96. You mean the thrown-out portions of the fabric will be smooth at a speed of about 120 to 150 r. p. m. Is that correct?

"A. They are smooth at that speed and *become so somewhere between* 80 r. p. m. and 120 r. p. m." (I-68).

Browne's testimony that the "*skirts are thrown out at substantially right angles to the plane of the core* * * * *when rotating at about 80 r. p. m.,*" brings State's so-called "high speed" down to or within the prior hand-spinning practice, and shows that State's alleged discovery was merely one of *degree*, and not of *kind*. At any event, State's testimony shows that if any discovery was made along this line, *he did not make* it and *does not know who did*. Furthermore the point is not sufficiently defined in the State patent to sustain a claim, either for a *method* or for a *mode of operation*.

These final considerations further confirm the conclusion reached above, that the mechanical means set forth in the Mathern Belgian patent are not only *adapted* but are *intended* to carry out the prior-practice hand-method of building tires, and to accomplish the same result by the *identical* mode of operation which is said to be inherent in the machine of the State patent; and that, therefore, *the Belgian patent in itself*, completely anticipates the State patent, not only with respect to the machine disclosed therein, but with respect to the *method* as well as the *mode of operation* said to be inherent therein.

RADIAL STRETCH THEORY.

Although the deciding judges in the Circuit Court of Appeals for the Third Circuit, seem to concede the prior practice of the *double-stretch* and *roll-spinning* meth-

od of building tires by hand, their decision appears to be founded on the idea that the operation of the State machine is something *wholly different* from the original hand process; and it is difficult to reconcile the seemingly divergent statements on this point in the opinion by Circuit Judge *Buffington*, as follows:

> "Leaving aside the tires made by a single stretch of fibrous material, and which were forced into place on the side of the shoe by what are known as "jigger fingers," and confining ourselves to shoes in which the material is stretched at different parts of the shoe in two directions at right angles to each other, and to a process of cementing or plastering them in place by a spinning roll, *we note the fact that tires embodying these two features of double stretch* and *roll-spinning fastening, were before the patent to State here in question, hand-made*" (II-404).
>
> "Far from being separated, isolated zone processes, there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the consequent exercise of the centrifugal force on the covering material, by which it is *automatically* gradually *stretched radially* and by the joint action of *such centrifugal, radial stretch*, and the spinning rolls, the square of the median zone progressively shades into the radial diamond shaped interstices of the bead or inner zone of the shoe. In a way we have anticipated what State's machine really is, by thus describing its results. But such statement should be initially made, for the *crux and dominating functional feature* of State's machine is the use upon the fabric of a centrifugal force caused by rapid rotation, *a process which is wholly different from the original hand process.*" (II-401)

It is very difficult to see wherein there is anything "*wholly different*" in the "*use upon the fabric of a cen-*

trifugal force caused by rapid rotation," from the *"double stretch roll-spinning fastening"* which was used in the prior practice; unless it be the ***rate*** of such rapid rotation, which is obviously a matter of *degree* and not of *kind*, and was inherent in the Mathern machine, or perchance the so-called *automatic graduation of the radial stretch*, which was likewise inherent in the Mathern machine.

Upon a showing less complete as to the prior practice, but *with machines in actual operation before them*, which does not appear to be the case in the Third Circuit, the judges in the Circuit Court of Appeals for the Sixth Circuit reached a diametrically opposite conclusion, in the opinion by Circuit Judge *Denison*, as follows:

> "Plaintiff really presents his case on the theory that State discovered a *new method* of making tire casings or a new set of functions to be performed by associated mechanism" (Pet. for Cert. p. 35).
>
> "We prefer to point out also that State had nothing broadly new either in his *method* or in his *selected tools*" (*Ibid.* 35).
>
> "The evidence that this *identical spinning operation* was performed upon tire casings by hand tools before State's invention is sufficiently satisfying to meet all the requirements of the situation" (*Ibid.* 36).
>
> "The Belgian tool in its radial progress was *bound to stretch and reshape* the fabric in substantially the same way that is done by State. Putting all these things together, State cannot be considered as the inventor of the *method*" (*Ibid.* 38, 9).
>
> "We are told that the centrifugal force disclosed by State's operation caused the unattached skirts of the fabric to fly out at right-angles to the plane of the core, and that the effect of the spinning tool slowly advancing against this skirt was to

produce a 'hinging and folding action' which was novel and important. *We are not impressed by this claim.* These words do not seem very appropriately descriptive, but the action which takes place not only pertains to a *method* or *process* rather than to any particular mechanism, but it was more or less *inherent in the rapid revolution of the core effected by older means,* and in the use of any spinning, stitching or creasing rollers" (*Ibid.* 42, 43).

"Perfectly successful spinning *performed in court,* upon a slowly revolving core, demonstrates that the outflying skirts are *not essential.* To make centrifugal force an effective basis of validity in the State patent would be to give a monopoly of the spinning *process* or of *rapid core rotation;* and *each was old*" (*Ibid.* 43).

The fact that slowly-revolving spinning-operations performed in court, demonstrates that the outflying skirts are not essential, and the further fact that the prior spinning practice produced *hand made* tires quite as good as *machine made* tires, upon cores rotating at very little if any less speed than is said to be effective in the State machine; naturally suggests that there must be something wrong with the theory that centrifugal force is the controlling factor in effecting this radial stretch in the unattached skirts of the fabric.

Obviously, the facts do not fit the theory, for the reason that when the alleged action of centrifugal force is most needed, there is less of it available for effective action. The maximum width of the unattached fabric to be acted upon extends outward from the neutral zone at the side of the core, and as the spinning operations gradually applies the skirt to the core, there is a corresponding gradual decrease in the width of the unattached fabric to be acted upon by centrifugal force, until it is re-

duced to a minimum, or vanishes to nothing at the base of the core.

The requirements of the radial stretch operation, however, demand that the force applied shall *increase* from a *minimum* at the neutral zone on the side of the tire, to a *maximum* at the base of the tire; and if the action of centrifugal force is depended upon for this purpose, it gradually vanishes to nothing when it is most needed.

The beneficial function of centrifugal force would rather seem to be the action of throwing the fabric outward into a cylindric form so as to circumferentially stretch out the large baggy folds which would otherwise hang from the line of attachment; thus leaving the spinning rolls free for the work of radially stretching the fabric as it is gradually applied to the core, by the frictional contact of the edge of the roll by its direct pressure on the fabric *as it is positively backed by the core.*

There is support for this view in the testimony of plaintiff's expert Browne, as follows:

> "My observation is that the skirts are thrown out at substantially right angles to the plane of the core * * * at about 80 r. p. m., but at that point the skirts *are not smooth*, but still present *waves or corrugations.* These waves or corrugations *disappear*, however, at a higher speed, such as that employed in the Goodyear commercial machine and the centrifugal force is then *utilized to good advantage.*"

Thus the "*good advantage*" which is said to result from the action of centrifugal force would appear to be the elimination of the baggy condition of the fabric; and the relatively *slight* pressure which the outthrown fabric may exert at the edge of the spinning roll, as compared with the *positive* resistance of the core to the pressure of

the spinning roll, would not seem to materially affect the radial stretching action thereof.

At any event, the frictional contact would be limited to the extreme peripheral edge of the spinning roll, because the cylindrical skirt could not be *circumferentially* stretched enough to cause it to fold or wrap around the edge of the roll in the manner suggested on behalf of the plaintiff.

There is further support for this view in the testimony of Derry, as follows:

> XQ. 48. Why did you want to give it so high a velocity?
>
> A. To make your number a good deal easier, to get the speed to pull the fabric down. Run it on low speed, wouldn't flare out; on high speed, it would flare out.
>
> XQ. 49. Why did you want it to flare out?
>
> A. So the fabric *wouldn't wrinkle.*

According to this witness, the principal purpose of throwing the fabric out was to avoid wrinkles, and it is obvious that when the unattached skirt is once thrown *straight out*, by the speed employed in the hand practice, it assumes the position of an endless band attached at one side to the core, which would prevent any further radial movement outward without a *circumferential stretching* of the fabric. In other words, when the fabric skirts are thrown out *straight*, as in the hand practice, the benefit of any increased action of centrifugal force would seem to be negligible.

The baggy waves or corrugations in the unattached fabric clearly appears in Plaintiff's Exhibit No. 35—Photographs State Machine, Nos. 1 and 2 (II-189, 91), and in Defendant's Exhibit D—Photograph Mathern Machine, Nos. 5, 7, 8, 9, 10, 11, 14, 15, and 16, *infra;* and the latter pictures show that the slightly crimped zone which

may be produced in the edge of the fabric by the Mathern machine, does not materially affect the baggy condition of the unattached skirts, shown for a plain edge in picture No. 18.

The conclusion is therefore compelling that, after giving full effect to the disclaimer of record, there is nothing left of the State patent save a series of directions for the use of the admittedly old mechanical combinations; which directions merely describe a manner or mode of *operating* the State *machine*, to perform the same *functions* for shaping, spinning and radially stretching fabrics, by the same *method* or mode of *operation*, which the deciding judges in the Third Circuit *conceded to be old* in their preliminary finding of facts, quoted above.

STATE PATENT No. 941,962.

The operation of machines said to embody the invention of the State patent, was exhibited to defendant's expert, Frank N. Waterman, at the Goodyear factory by plaintiff's Counsel, and his expert Mr. Ray; and the operation of these machines is well described by Mr. Waterman, and serves to confirm many of the conclusions which have been reached on other grounds, as follows:

> "The high speed was 120 R. P. M. instead of 207" (I-231).
>
> "The machines shown me were not all alike, but the arrangement in each case was such that *the spring played little or no part in the operation*, the pressure being as I judged practically wholly applied by the operator leaning heavily against this handle while performing the spinning operation. In other words, the operator appeared to be making

fully as much physical effort in this spinning operation as in the cases where I have seen the spinning operation performed by hand" (I-232).

"The spinning rolls appeared relatively larger than is indicated in the State patent and they acted under the heavy pressure applied by the operator against the core as in ordinary hand spinning and * * * did manifestly compress or pinch the fabric between the roll edges and the core precisely as in hand spinning; and this was evidenced when the spinning was completed by the *pressure line left on the fabric which showed the path of travel of the spinning roll.* * * * Such a line is left by the hand spinning roll as used in the hand spinning as I saw it in use many years ago" (I-232, 3).

"The work which I saw was not as the patent says (page 7, line 49) 'better than they can be made by hand,' but was *extremely poor, much worse* than I remember having seen it done by hand and indeed *the faults of the machine had to be remedied by hand* both while the core was attached to the machine and after it had been removed therefrom.

"In practically every layer of fabric applied very large and very bad wrinkles were formed and *it was necessary to stop the machine and lift up the fabric and smooth it down by hand with a spade,* after having applied cement underneath in some instances" (I-233).

It goes without saying that the demonstration given to defendant's expert by plaintiff's counsel and plaintiff's expert, was undoubtedly carried out under the most favorable circumstances and conditions to present the best operation of State's machine, and the foregoing testimony shows that these machines are subject to substantially the same difficulties which are said to be inherent in the operation of spinning tires by hand.

It might be assumed *a priori*, that a machine made tire would not be as perfectly formed or wear so well as a hand-made tire, because of the intimate attention to all the details which must be given by the manual worker, just the same as watches, shoes, and all kinds of wearing apparel are always known to be better made by *hand* than by *machine;* and the record here shows that hand-made tires are *just as good*, if not better, than machine made, tires even though they are made by a machine under the State patent.

It only remains to repeat that the *method* carried out by the State machine is anticipated in every material respect by the prior hand practice and also by the operation of the Mathern Belgian machine, and that the *machine* of the State patent as well as its *mode of operation*, are both anticipated by the machine and mode of operation of the Mathern Belgian patent; and that in each case the anticipation goes to each and every limitation and every condition which has been imposed upon the claims of the State patent by the disclaimer of record.

METHOD AND MODE OF OPERATION.

The undisputed facts here present are believed to lead so naturally to the foregoing conclusions, that the same need only be stated to readily come within the established principles of patent law, which will naturally suggest themselves to the Court without the need of citing the authorities herein.

If it should be urged, however, that the foregoing conclusions are not correct, they are believed to come fully within the reasoning of Robinson, so well set forth in the note to Section 172 of his Treatise on the Law of Patents, as follows:

"Where a process consists entirely in the operation of a machine or other instrument, it approaches so nearly to the function of the instrument employed that several decisions have been rendered identifying it therewith, and hence denying its patentability.

"But the process and the function are, after all, two entirely separate entities, both in intellectual and physical contemplation; the former being capable of conception apart from any object acted on, the latter not so.

"The difficulty is another form of the old confusion between the end and the means, and is to be avoided by defining sharply the end to be accomplished, and determinnig whether the machine or the operation performed by it is the actual means.

"For if the operation performed by the machine is new in reference to the object upon which it is employed, a new process has been invented; and this is no less true if the machine or instrument employed is new than if it were old, or if the process can be performed in no other known way than by this particular machine.

"While, on the other hand, *if the operation is known in reference to the object,* the invention of a new machine for performing it does not make a new process, but only a *new instrument* for applying it."

"Whether or not a new machine is the reduction to practice of a new process, or is a new instrument for the performance of an old process, is, therefore, *to be determined by the state of the art* at the date of the invention.

"If it is the former, the process is patentable, though the machine be new. If the latter, *only the machine can be allowed the protection of the law.*"

The application of these principles to the present case is so obvious, as to render argument superfluous.

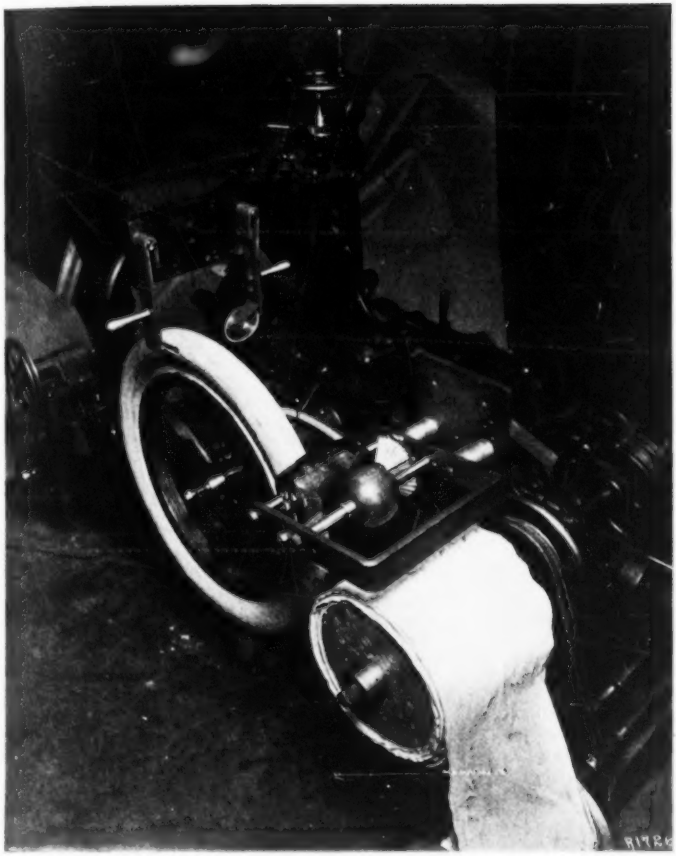
Respectfully submitted,

HARRY FREASE,

Amicus Curiae.

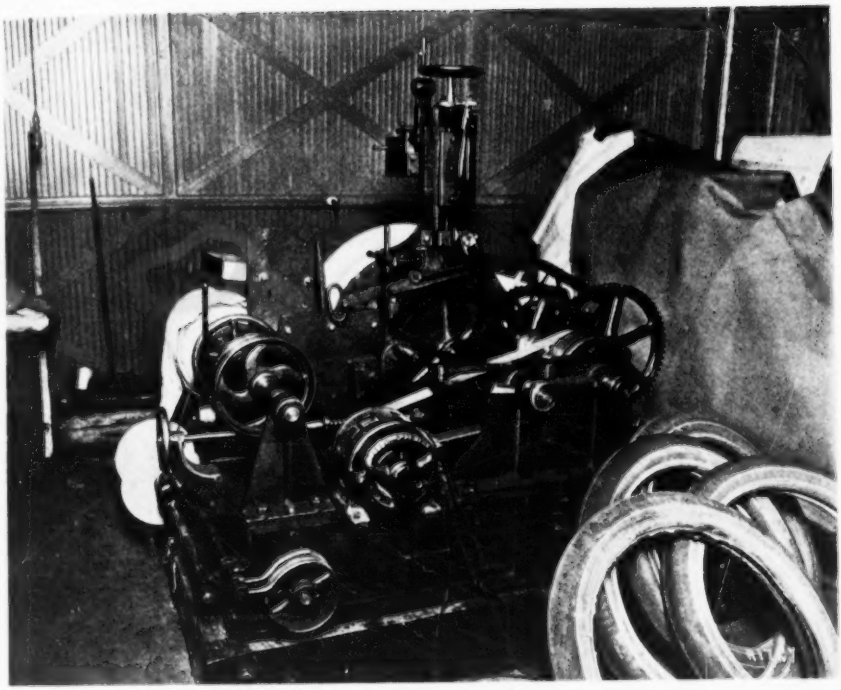
Canton, Ohio,
December 1, 1923.





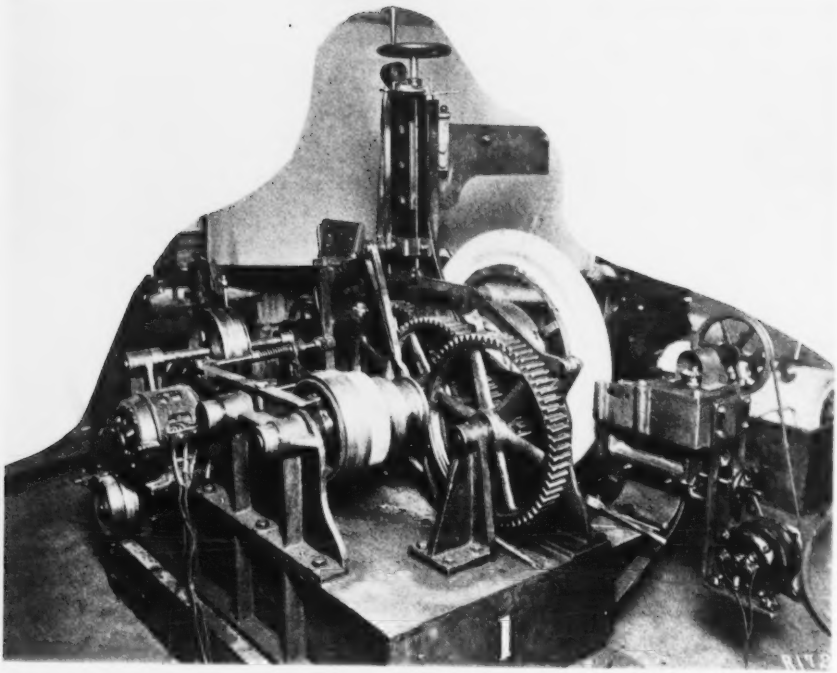
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 1. A perspective view of the machines, looking downward at the forward side of the machine from its right-hand corner.



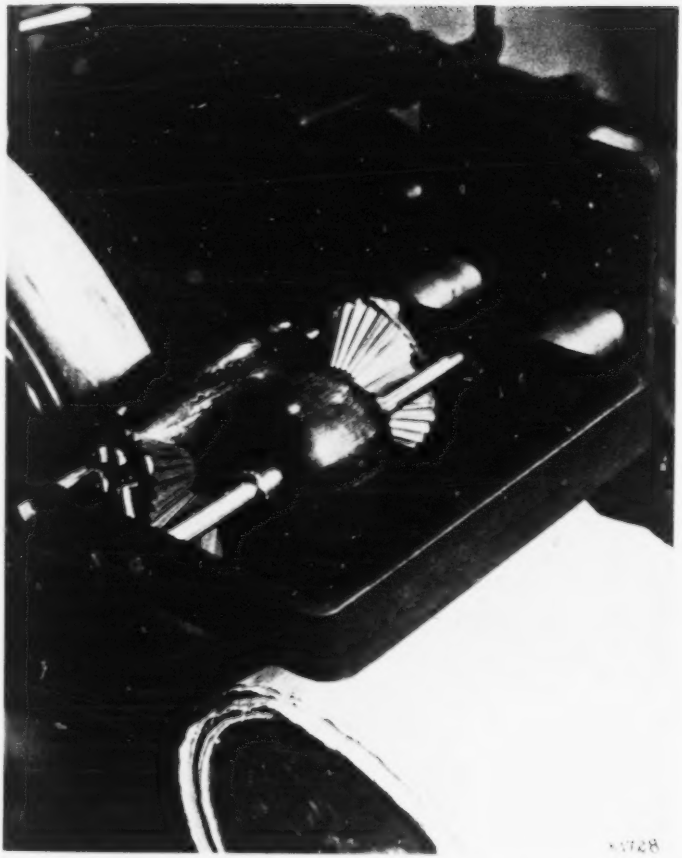
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 2. A perspective view of the rear side of the machine, looking at its left-hand corner, and showing some of the finished tire casings built on the machine.



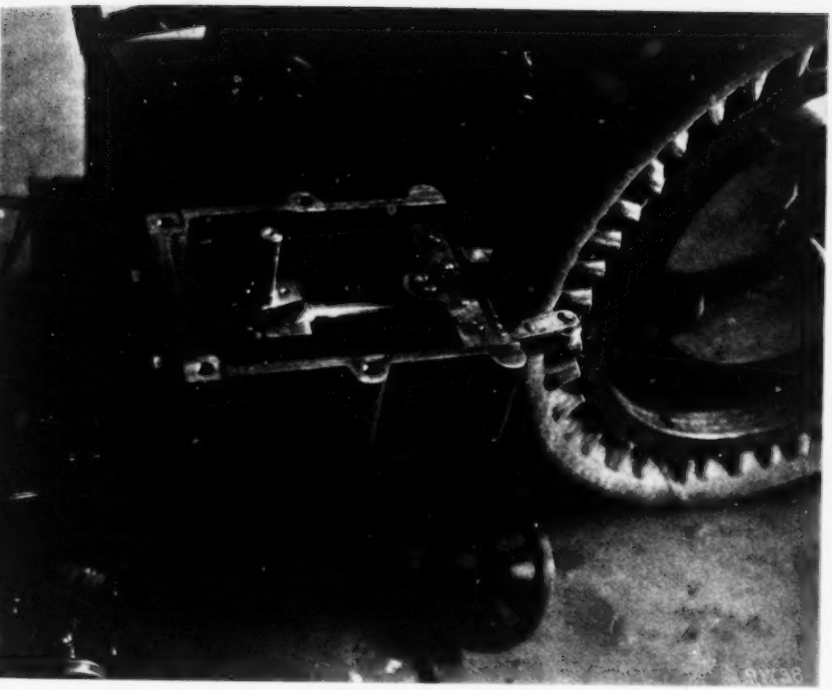
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 3. A perspective view of the rear side of the machine from its right-hand corner.



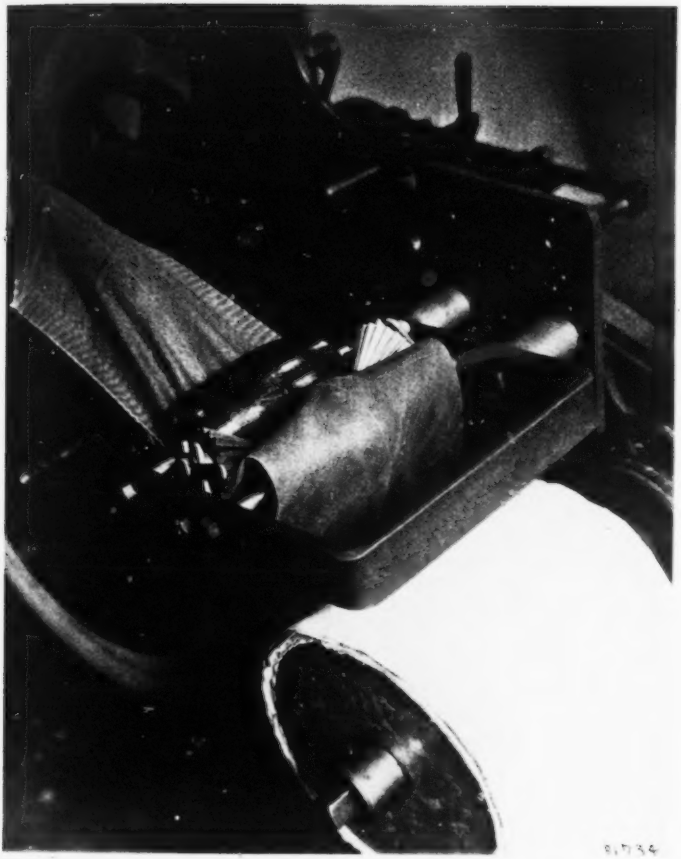
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 4. A perspective view of the conical gears and spherical and oval rollers.



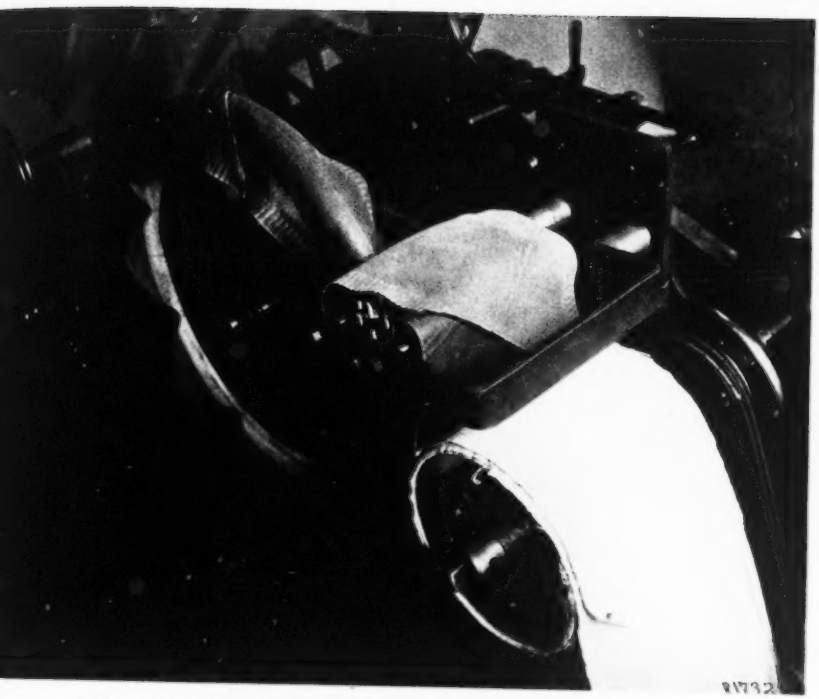
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 5. A perspective view of the box or casing and reciprocating slide, carrying the rollers 30 of the Belgian patent, the cover of casing being removed to expose the parts beneath it.



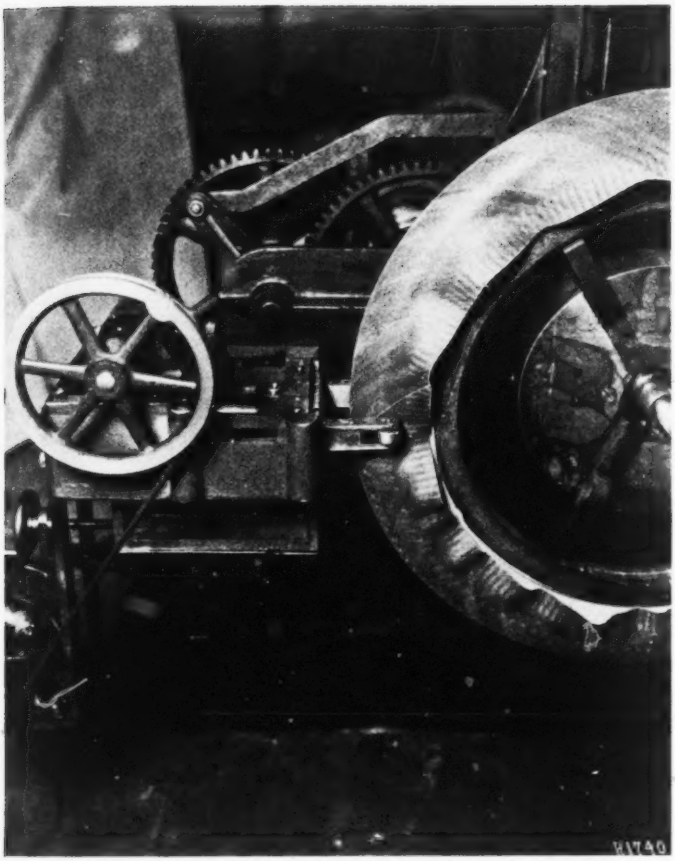
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 6. A detail perspective view of the conical gears and the rollers, showing the initial application of the first strip of fabric to the core.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 7. A similar view showing the layer of fabric completely wound around the core with its ends spliced ready for the next succeeding operation.



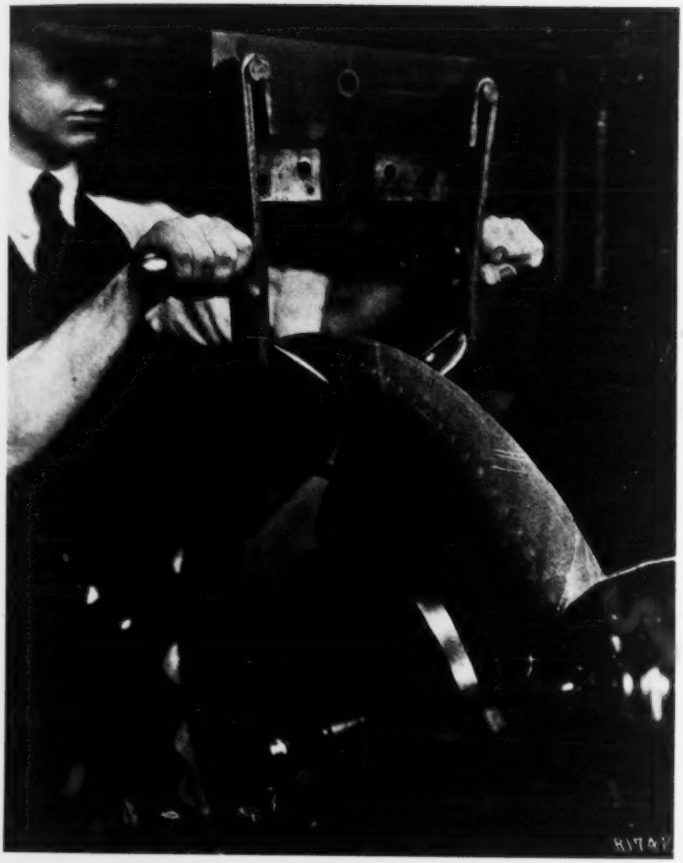
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 8. A detail side elevation showing the action of the rollers 30 on the fabric on the core, the portion of the fabric below the rollers having been acted upon by them and the portion of the fabric above them not having reached them in the rotation of the core.



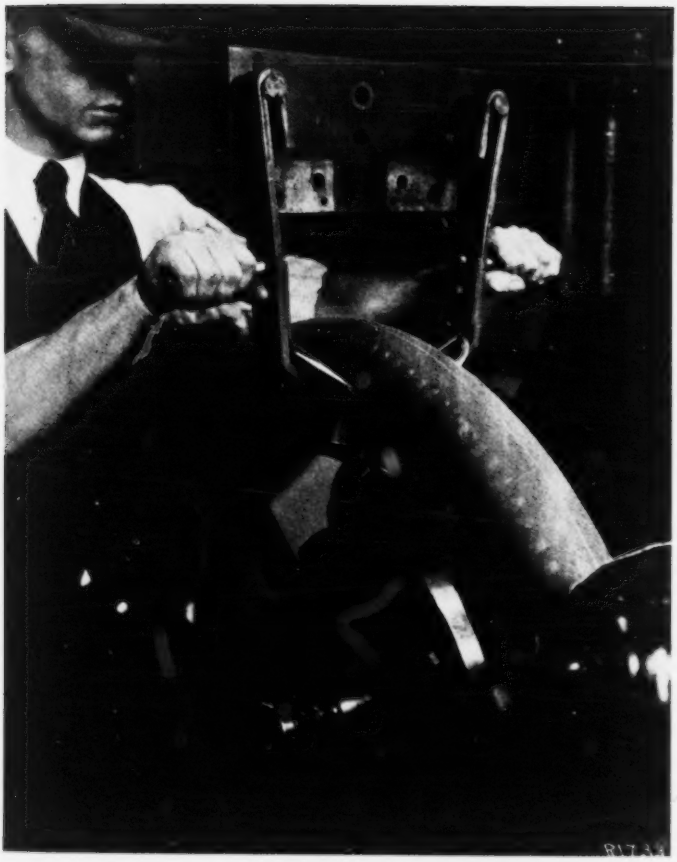
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 9. A perspective detail showing the co-operation of the rollers 30 with the core, this view being taken from a point showing the inner part of the core. In this view the core has made a complete rotation past the rollers 30, so that they have acted upon the entire circumference of the fabric.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 10. View showing the operation of the spinning rolls at or near the beginning of their action upon the sides of the fabric.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 11. A later stage of the same operation.



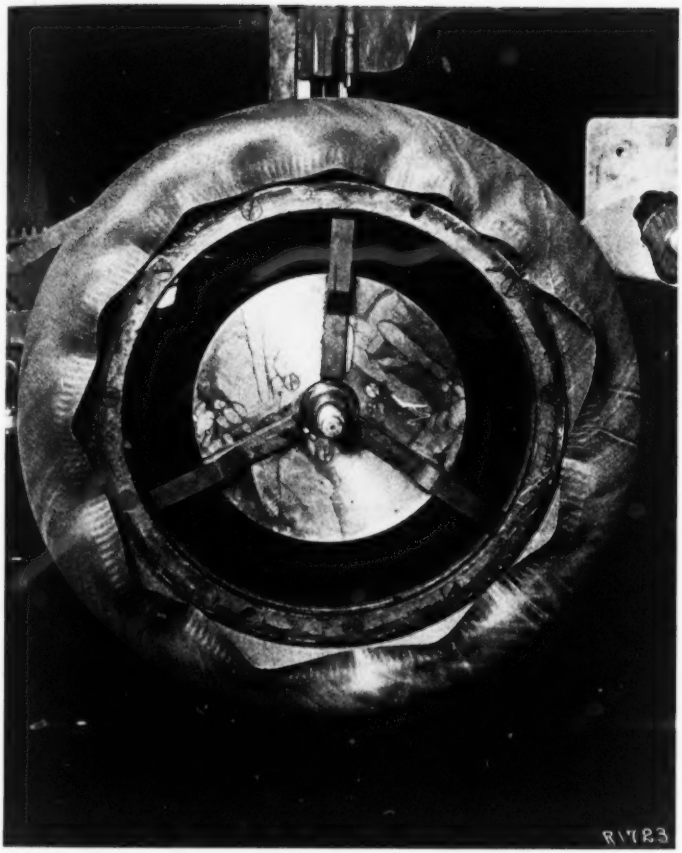
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 12. View showing the spinning rolls at the completion of their operation.



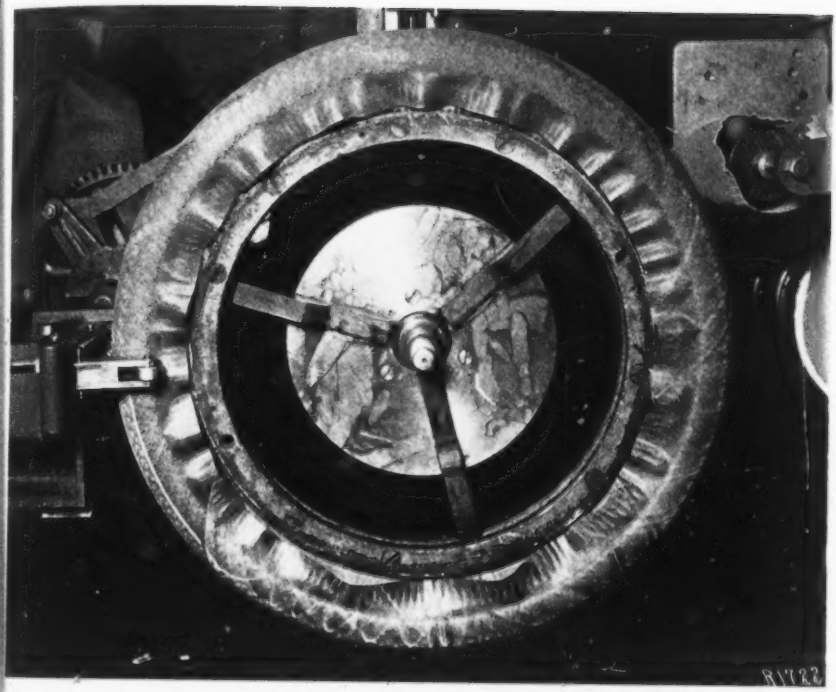
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 13. A side elevation of the core showing the first layer of fabric thereon after the completion of the operation of the spinning rolls.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 14. A similar view showing the second layer of fabric stretched around the core with its ends spliced ready for the next succeeding operation.



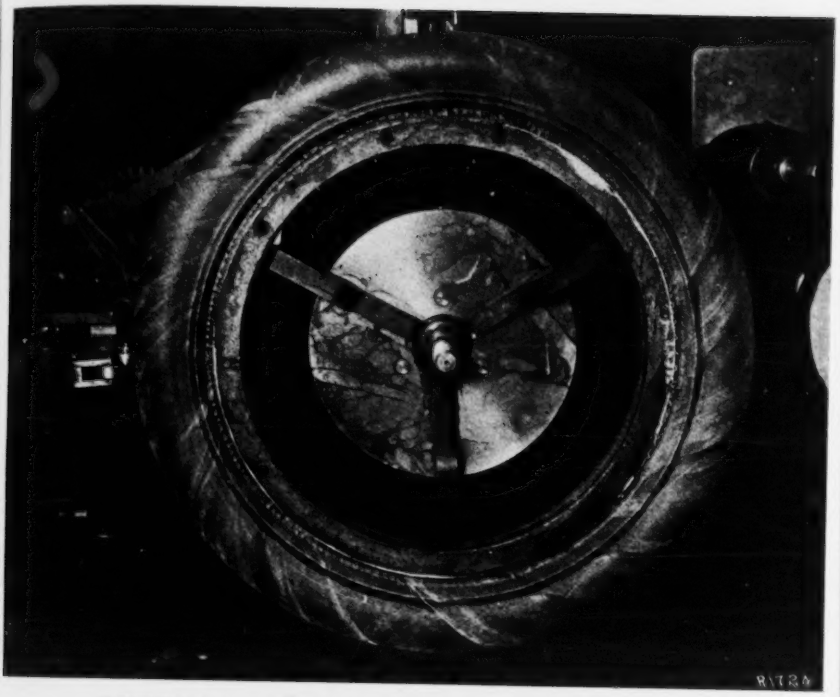
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS
MATHERN MACHINE

No. 15. A similar view showing the second layer of fabric after it had been acted upon by the rollers 30.



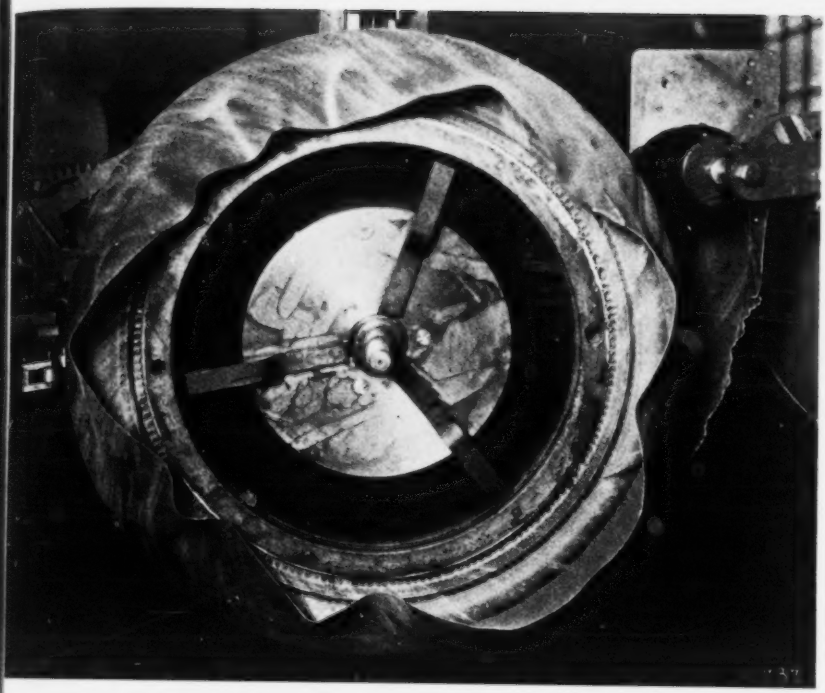
DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 16. A side elevation showing a later stage of operation, after the beads have been applied over the first two layers of fabric and the third layer has been wound upon the core and its ends spliced together for the next succeeding operation.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS MATHERN MACHINE

No. 17. A similar view showing the third layer of fabric after it has been acted upon by the rollers 30 and the spinning rolls and spun down over the beads.



DEFENDANT'S EXHIBIT D—PHOTOGRAPHS
MATHERN MACHINE

No. 18. A side elevation showing a strip of fabric wound upon the core without having been acted upon by the conical gears, the upper gears having been removed.

BELGIAN

MATHERN PATENT

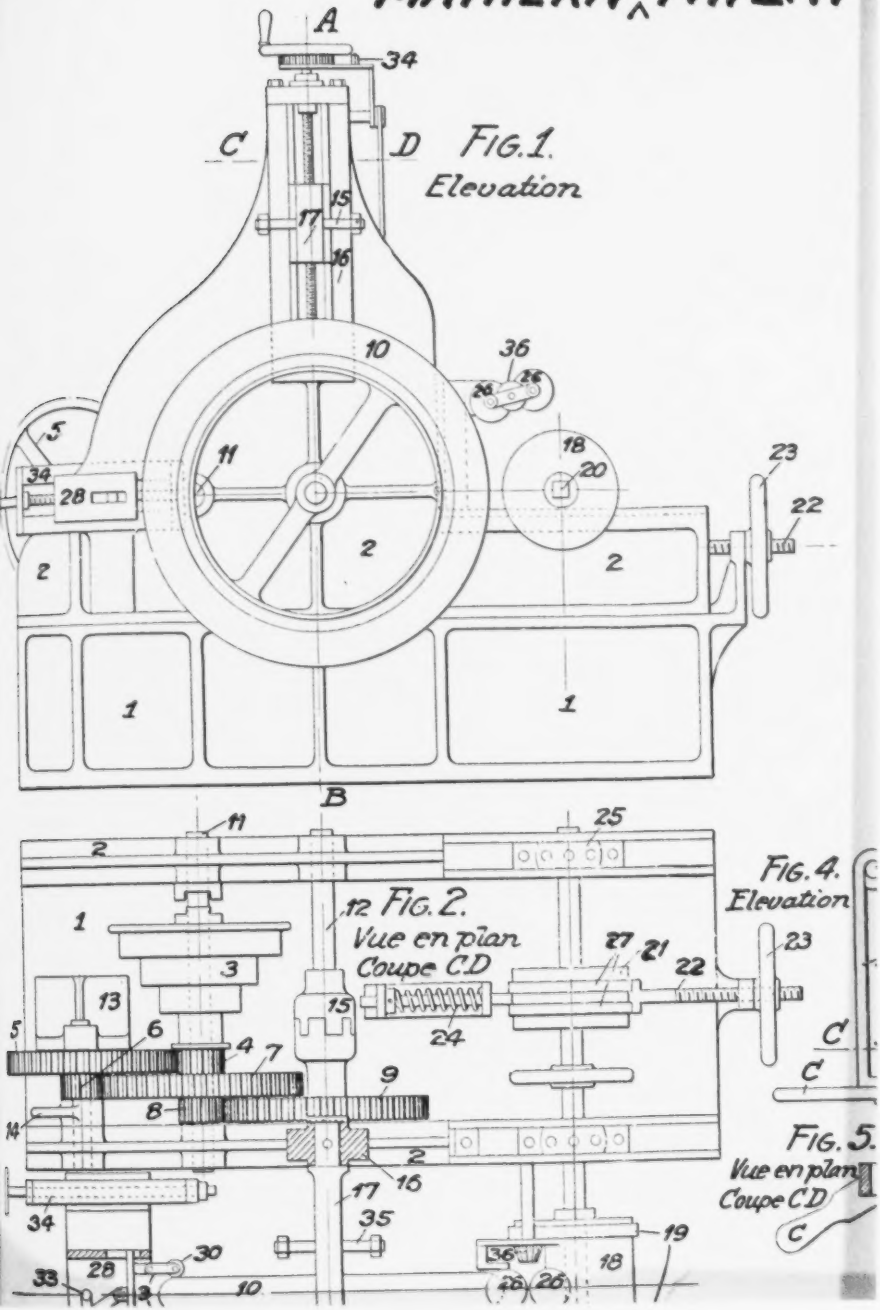


FIG. 1.
Elevation

FIG. 2.
Vue en plan
Coupe C.D

FIG. 4.
Elevation

FIG. 5.
Vue en plan
Coupe C.D

PATENT Nº 194.731

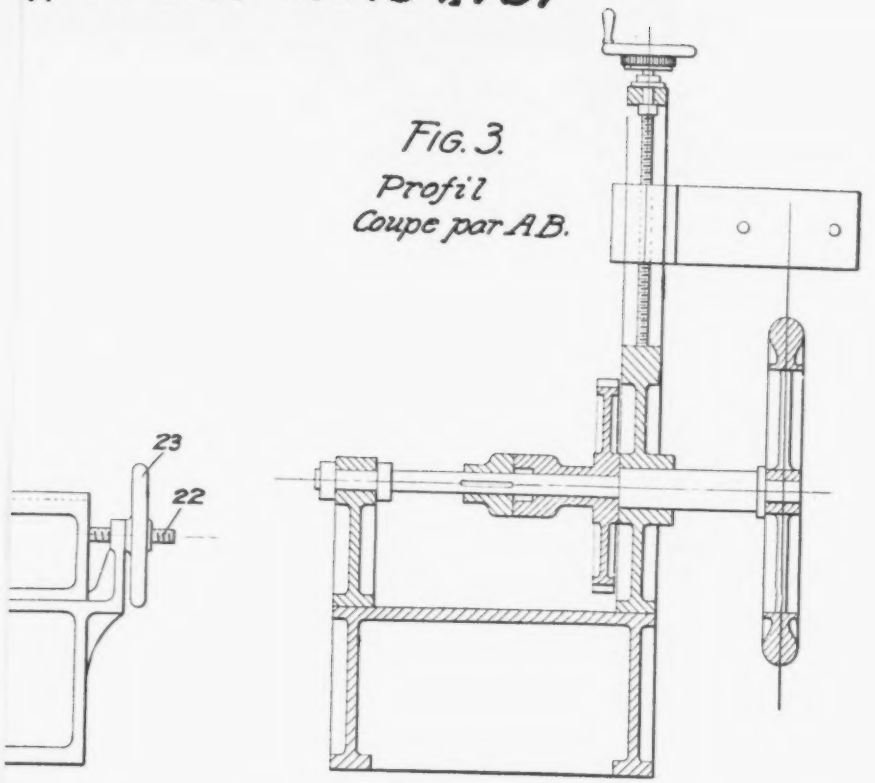


FIG. 3.
Profil
Coupe par AB.

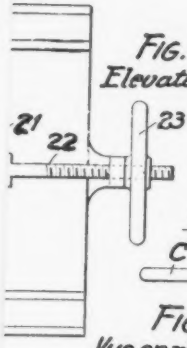


FIG. 4.
Elevation

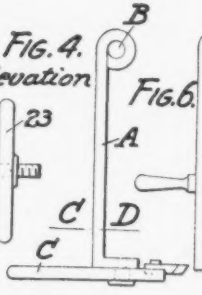


FIG. 6.

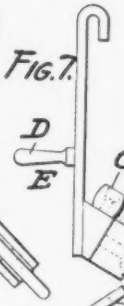


FIG. 7.

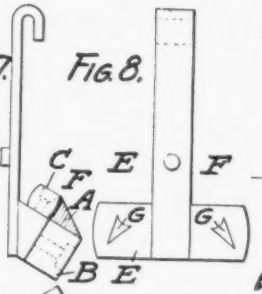


FIG. 8.

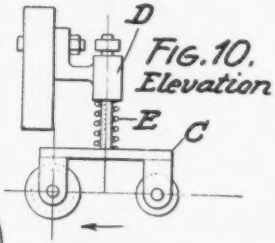


FIG. 10.
Elevation

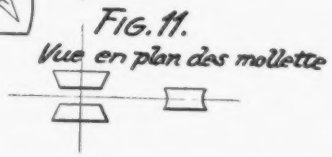


FIG. 11.
Vue en plan des mollette

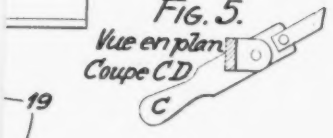


FIG. 5.
Vue en plan
Coupe CD



FIG. 9.
Vue en plan
Coupe EF

Bruxelles le 20 Septembre 1906
Pas Pon & Wt A. Matherne.

FIG. 1.

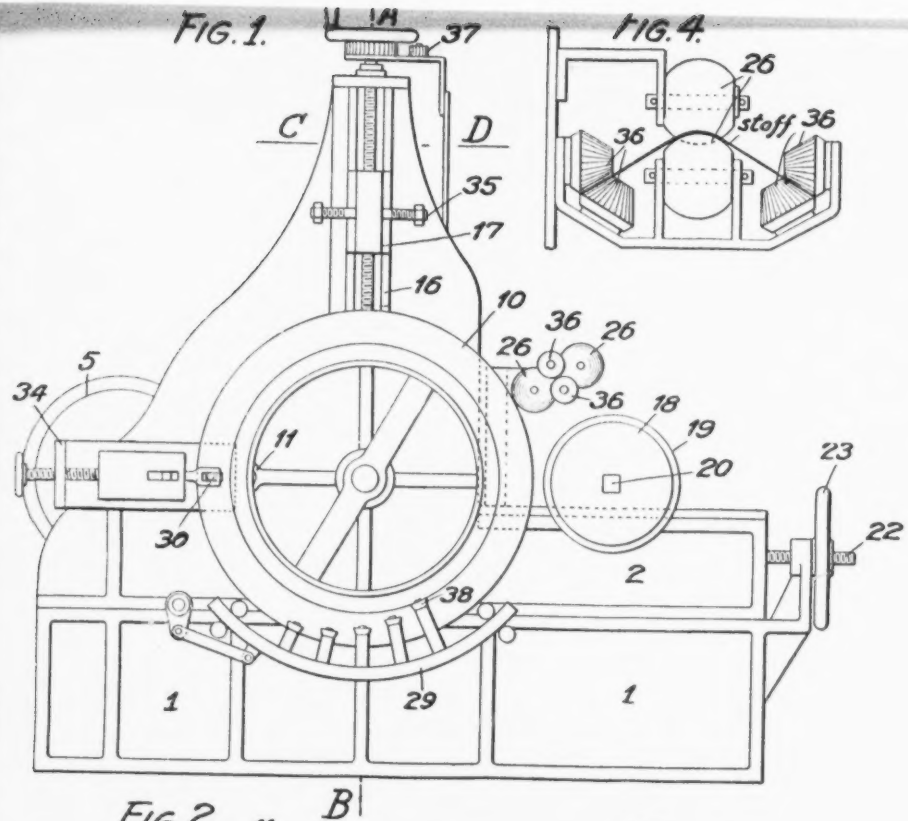


FIG. 4.

FIG. 8.

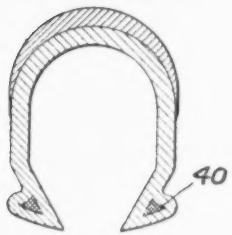


FIG. 3.

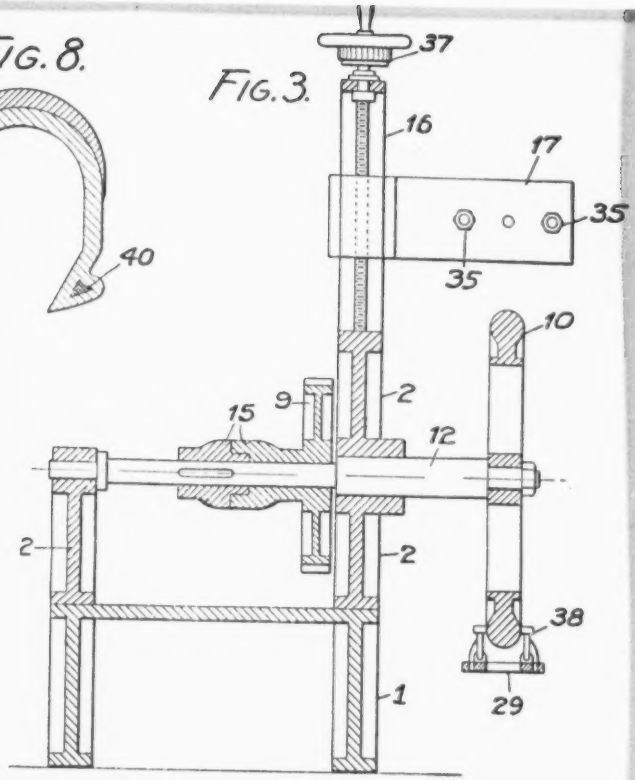


FIG. 2.

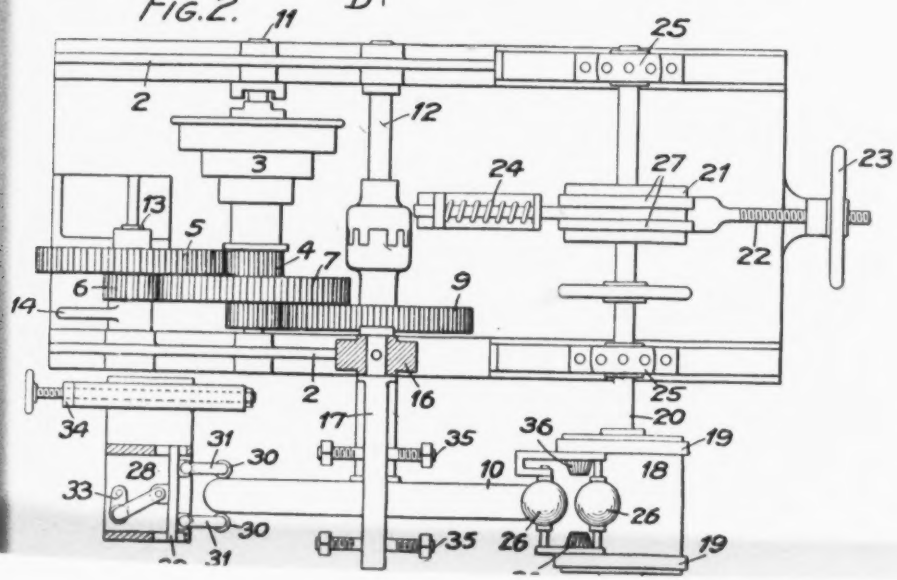


FIG. 5.

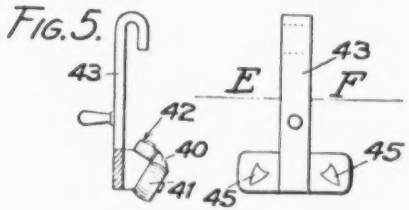


FIG. 6.

FIG. 7. Schnitt E-F



Vol. II.

TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, [redacted] 1923

No. 774 185

THE JOHN E. THROPP'S SONS COMPANY, PETITIONER,

vs.

FRANK A. SEIBERLING.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

PETITION FOR CERTIORARI FILED JANUARY 2, 1923.

CERTIORARI AND RETURN FILED MARCH 20, 1923.

(29,324)

(29,324)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1922.

No. 774.

THE JOHN E. THROPP'S SONS COMPANY, PETITIONER,

vs.

FRANK A. SEIBERLING.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

VOLUME II.

INDEX.

	Page.
Plaintiff's Exhibit No. 1—State patent No. 941,962	1
No. 2—Thropp and De Laski patent No. 1,119,326.	25
No. 4—Diagram of original flat fabric before shaping	59
No. 5—Diagram of fabric shaped to core	61
No. 7—Diagram of saw-tooth path of hand tool	63
No. 8—Sketches of experimental work, numbers 1 to 15, inclusive	65
No. 10—Diagram of carcass and wheel rim	99
No. 11—Photograph of manual circumferential stretching	101
No. 12—Diagram of State's spiral path	103
No. 13—Stevens patent No. 1,253,105	105
No. 14—Copy of journal entitled "Moniteur Belge"	137
No. 16—Plaintiff's forms of license agreement since January, 1919	143

JUDD & DETWEILER (INC.), PRINTERS, WASHINGTON, D. C., APRIL 4, 1923.

Page.

Plaintiff's Exhibit No. 17—Vulcanizing charts of Mackey and Shaw tires 149
No. 20—Sketch of Ray holding device..... 153
No. 21—Sketch of Ray bursting apparatus..... 155
No. 22—Extracts from "American Machinist Gear Book" 157
No. 23—Extracts from "The Theory of Machines". 159
No. 24—Extracts from "Pure Mechanism"..... 165
No. 26—Series of articles by F. A. Halsey on worm and spiral gearing in the "American Machinist"..... 167
No. 35—Photographs of State machines..... 189
Defendant's Exhibit A—Browne's sketch of gearing..... 191
F—Mathern Belgian patent No. 194,731 and translation 195
G—British patent No. 25,588 to State..... 229
J—Vincent patent No. 794,473..... 245
K—Seiberling and Stevens patent No. 762,561.. 257
L—Moore patent No. 518,112..... 273
M—Jeffery patent No. 607,245..... 285
N—Bayne and Subers patent No. 847,041..... 291
O—Translation of Mathern German patent No. 206,197 305
P—Translation of Hernandez French patent No. 395,812..... 313
Q—Dewey patent No. 438,407..... 319
R—Early Seymour patent No. 80,836..... 323
S—Later Seymour patent No. 376,167..... 327
U—Extracts from State's file-wrapper..... 335
Z—Ray sketch of Mathern Belgian patent, showing rolls 30..... 397
Opinion, Bodine, J..... 399
Final decree..... 400
Assignment of errors..... 400
Petition for appeal..... 401
Order allowing appeal and fixing bond..... 402
Citation and service..... 402
Proceedings in U. S. circuit court of appeals..... 402
Argument and submission..... 402
Opinion, Buffington, C. J..... 403
Dissenting opinion, Davis, J..... 415
Decree 417
Petition for rehearing..... 417
Affidavit of William H. Kavanaugh..... 423
George B. Pegram..... 425
Robert M. Anderson..... 427
Memorandum in opposition to petition for rehearing..... 429
Order denying petition for rehearing..... 432
Clerk's certificates..... 432
Writ of certiorari and return..... 433

PLAINTIFF'S EXHIBITS.

Plaintiff's Exhibit No. 1—Patent in Suit.
(State No. 941,962.)

W. C. STATE.

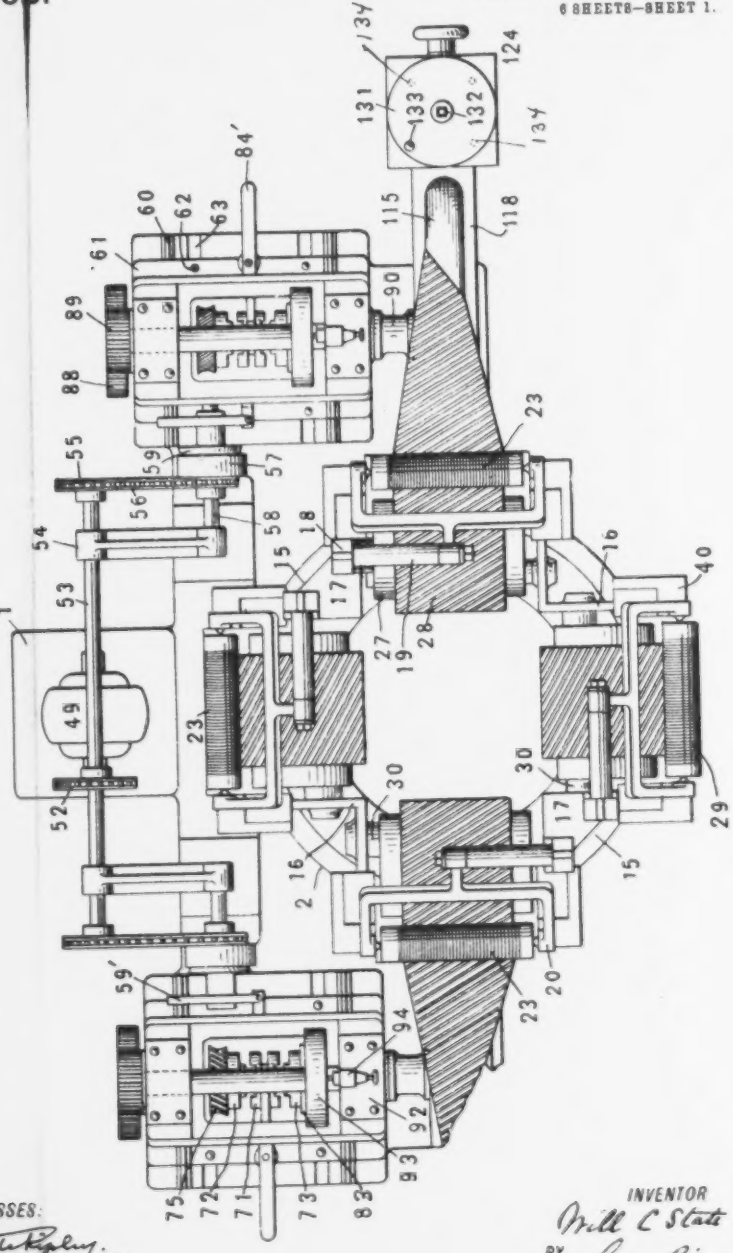
PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962. Patented Nov. 30, 1909.

6 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

J. Clyde Ripley.

M. Tuffly

INVENTOR

Will C State

BY Lamb Briesen

ATTORNEY

4

W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962.

Patented Nov. 30, 1909.

6 SHEETS—SHEET 2.

Fig. 7.

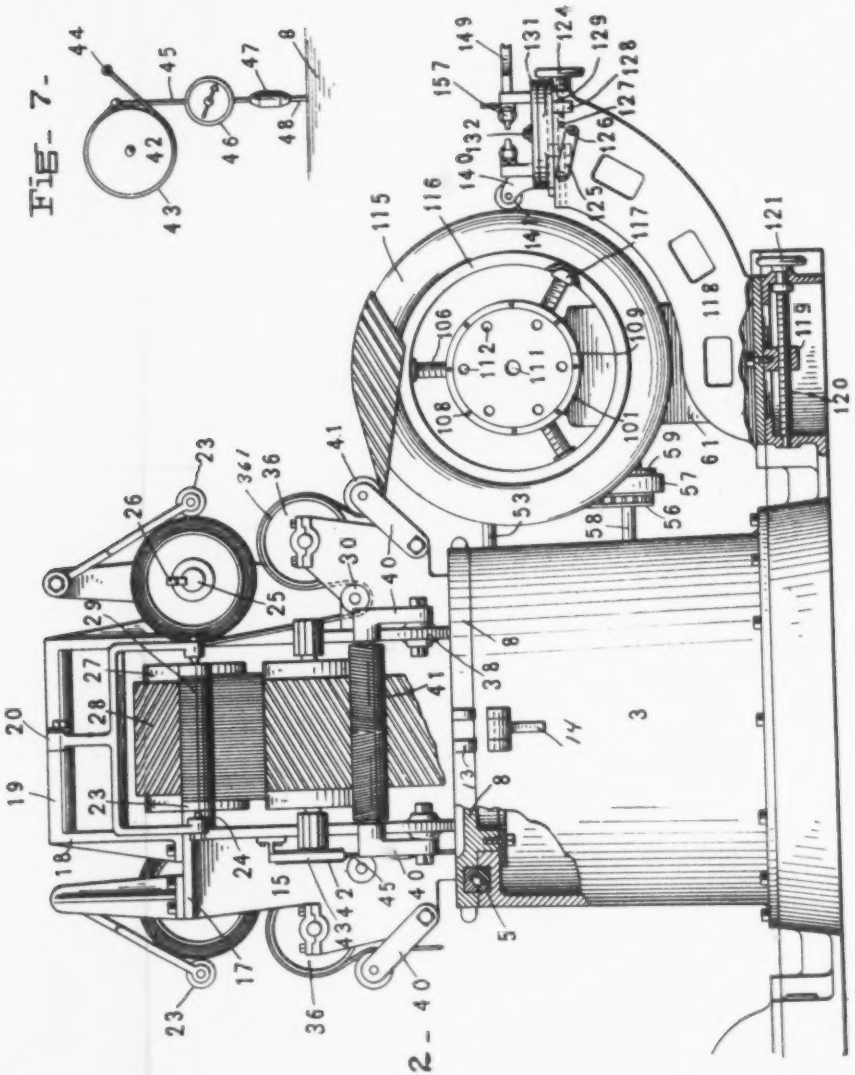


Fig. 2.

WITNESSES

J. Snyder Tyler.

M. Seligsoff.

INVENTOR

Will C State

BY Church Brown

ATTORNEYS

W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962. Patented Nov. 30, 1909.

6 SHEETS—SHEET 3.

Fig. 4

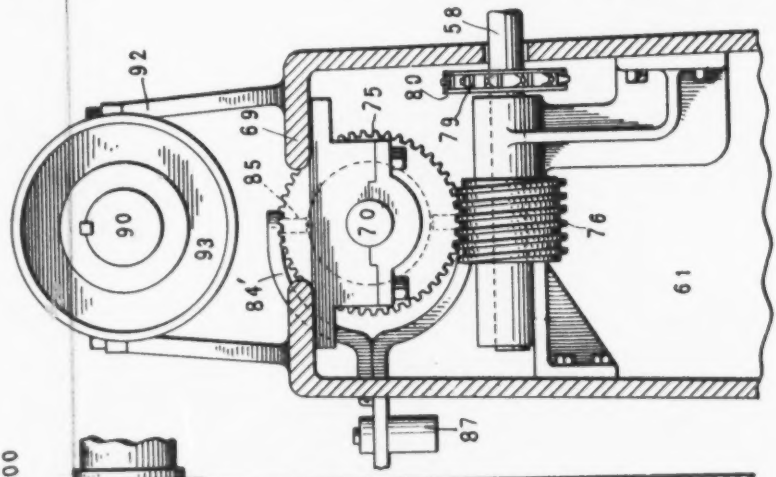
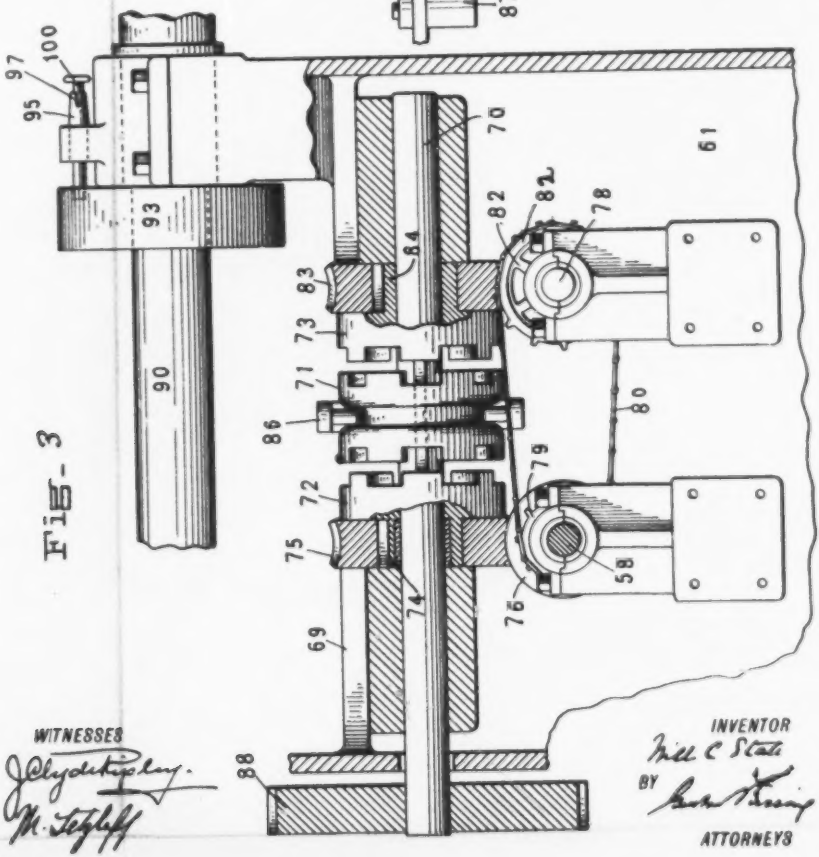


Fig. 3



WITNESSES

J. Clyde Kingsley.

M. Teigluff

INVENTOR

Will C State

BY

ATTORNEYS

8

W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962.

Patented Nov. 30, 1909.

6 SHEETS—SHEET 4.

Fig. 5

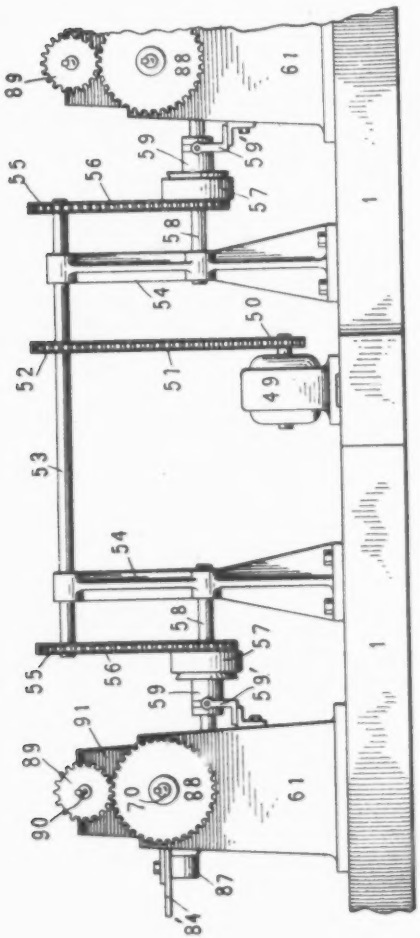
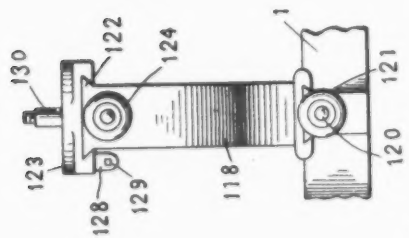


Fig. 6



WITNESSES

J. Clyde Kepley.

M. Tuffly

INVENTOR

Wm C State

BY Church & Church

ATTORNEYS

W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962. Patented Nov. 30, 1909.

6 SHEETS—SHEET 5.

Fig. 8.

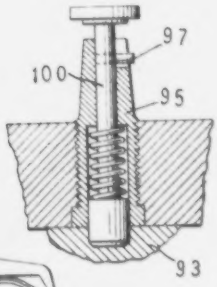


Fig. 9.

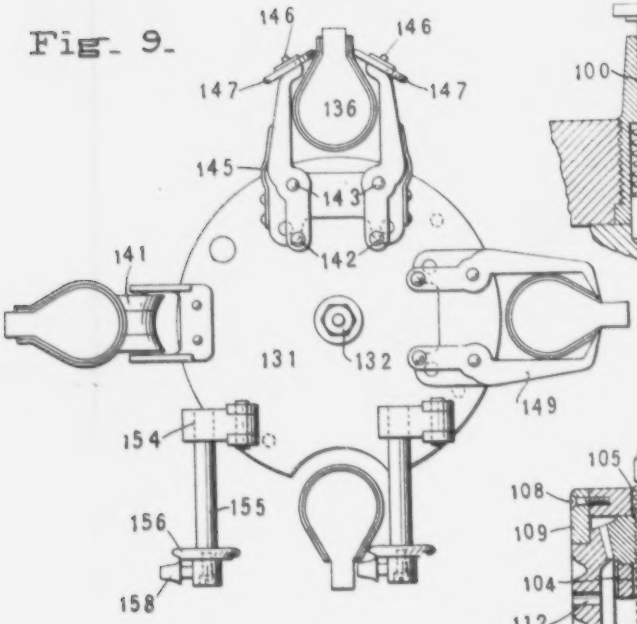


Fig. 10.

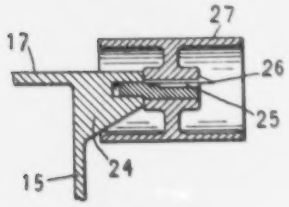
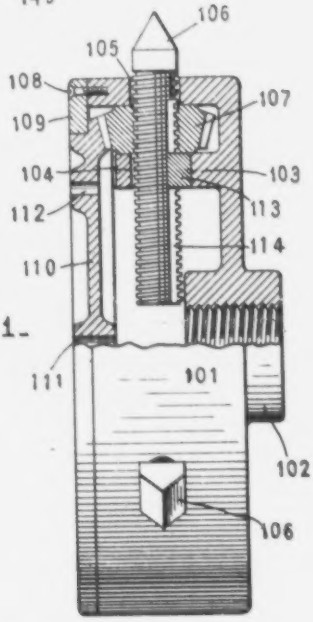


Fig. 11.



WITNESSES:

J. Clyde Tipley.

M. Tetzloff

INVENTOR

Will C. State.

BY Lucas Bros

ATTORNEY



W. C. STATE.

PNEUMATIC TIRE SHOE MANUFACTURING MACHINE.

APPLICATION FILED MAR. 26, 1909.

941,962. Patented Nov. 30, 1909.

6 SHEETS—SHEET 6.

Fig. 12.

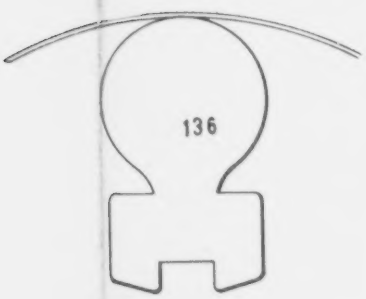


Fig. 12a.

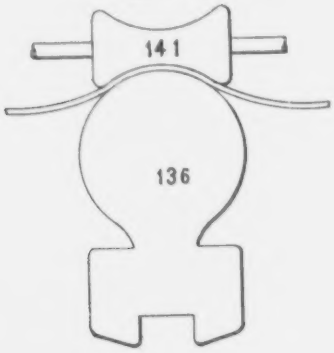


Fig. 12b.

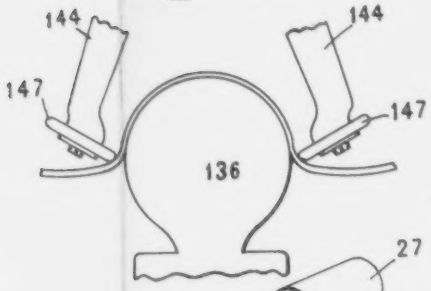


Fig. 12c.

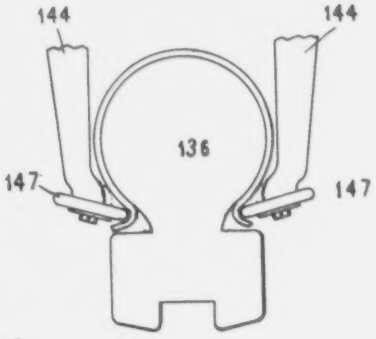


Fig. 13.

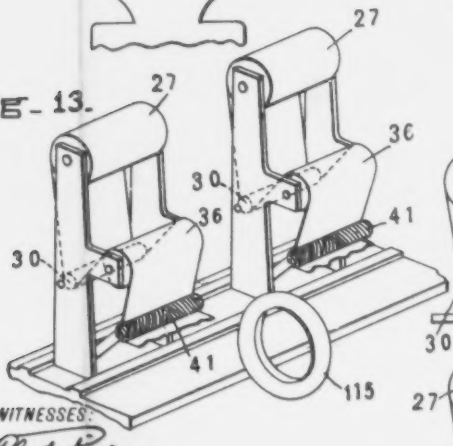
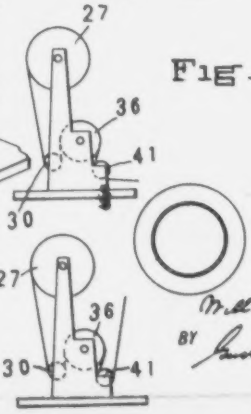


Fig. 14.



WITNESSES:

J. Lloyd Ripley

M. Seyloff

INVENTOR

Wm C State

BY

ATTORNEY

941,962.—*Will C. State*, Akron, Ohio. PNEUMATIC-TIRE-SHOE-MANUFACTURING MACHINE. Patent dated November 30, 1909. Disclaimer filed February 14, 1919, by the assignee, *Frank A. Seiberling*.

Enters his disclaimer as follows:

"First. In respect to each of claims 4, 5, 6, and 7 of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and coördinated for shaping and applying a previously unshaped sheet-fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the ring-core is rotatable at fast speed by the power-drive, whereby the unapplied fabric portion is thrown out from the side of the ring-core by centrifugal force, and the recited spinning-roll support is mechanically mounted to insure its radial movement with a gradual advance in proper relation to the fast rotating ring-core, whereby the spinning-roll, by such gradual advance over the ring-core and while pressed toward it, acts gradually upon the centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

"Second. In respect to each of claims 12 and 13 of said patent, I hereby disclaim any combination of the recited elements, *except for* the combined operations of first stretching the middle or tread portion of a previously unshaped fabric strip onto the recited ring-core and thereafter shaping and applying to the ring-core the fabric beyond the tread portion, *and unless* the recited elements are so constructed and coördinated that before the change from slow speed to fast speed the fabric strip as drawn from the recited stock roll onto the ring-core is stretched circumferentially under uniform tension while applying it to the tread portion, and, after the change to fast speed, the unapplied fabric beyond the tread portion is thrown out from the side of the ring-core by the consequent centrifugal force, while the recited spinning-roll, in its radial movement, acts gradually upon the centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core beyond the tread portion while bringing it into adhesive contact therewith.

"Third. In respect to each of claims 22, 23, 24, 25, and 26, of said patent, I hereby disclaim any combination of the recited elements *except when* constructed and coördinated for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion, *and unless* the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll, in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric, to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith.

"Fourth. I hereby further disclaim that part of the claim of invention in said patent contained in claims 8, 9, 10, 11, 14, 15, 16, and 17, respectively.

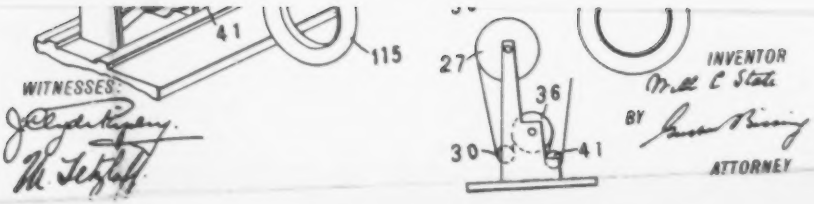
"Fifth. In respect to the specification of said patent, I hereby disclaim at page 1, lines 79–80, the words 'and an important feature of my invention,' and at page 1, lines 92–93, the words 'as another feature of my invention.'"

Disclaimer in Letters Patent No. 941,962.

ing machine of a power-driven ring-core with a pair of stock-rolls from which alternate layers of crossed fabric may be supplied to the ring-core is an important feature of my invention.

A layer of canvas having been applied to the ring-core, a radially movable smoothing or tread-forming roll firmly shapes and presses the canvas against the ring-core near its external periphery to form the parts to which some form of tension brake is applied. I have found, also, that the fabric in passing under tension from the stock-roll to the ring-core forms longitudinal creases. These I remove by a stretching-roll supplied with a pair of divergent spirals on its surface.

Without unduly extending this preliminary outline of my invention, I may say that an important feature of my machine


41
115
27
36
30
41
WITNESSES:
INVENTOR
BY
ATTORNEY

UNITED STATES PATENT OFFICE.

WILL C. STATE, OF AKRON, OHIO, ASSIGNOR TO FRANK A. SEIBERLING, OF AKRON, OHIO.

PNEUMATIC-TIRE-SHOE-MANUFACTURING MACHINE.

941,962. Specification of Letters Patent. Patented Nov. 30, 1909.

Application filed March 26, 1909. Serial No. 486,043.

To all whom it may concern:

Be it known that I, WILL C. STATE, a citizen of the United States, and resident of Akron, Summit county, Ohio, have invented a new and useful Pneumatic-Tire-Shoe-Manufacturing Machine, of which the following is a specification.

My invention relates specifically to the manufacture from flat sheets of rubber-coated canvas of the open-bellied casings or more briefly the open casings or tire-shoes which are used in connection with an inflatable inner rubber tube to constitute the double-tube pneumatic tires now used on automobiles and the like. Heretofore such open-bellied or open tire-shoes in so far as they have been made direct from sheeted fabric have been made by hand. By my invention they are made by the machine which is the subject of this application. It is the first machine, known to me, which has come into commercial use for this purpose of building tire-shoes from superposed layers of sheeted fabric in contradistinction to weaving the tires from threads which are woven or laid one after the other on the ring-core or former.

My machine comprises a power-driven ring-core in connection with a pair of stock-rollers which have wound thereon strips of canvas skim-coated with rubber and cut on the bias. By this means I am enabled to supply a round of canvas on the ring-core from one roll and then a second round of canvas on the ring-core from the other roll. By properly arranging the rolls with respect to each other, the superposed layers of canvas on the ring-core will have their threads crossed, as is necessary in building strong tires. The pair of stock-rollers may be mounted one above the other, or side by side on a sliding or rotary table so that the stock can readily be drawn therefrom to the power-driven ring-core in alternation. This combination in an open tire-shoe making machine of a power-driven ring-core with a pair of stock-rolls from which alternate layers of crossed fabric may be supplied to the ring-core is an important feature of my invention.

A layer of canvas having been applied to the ring-core, a radially movable smoothing or tread-forming roll firmly shapes and presses the canvas against the ring-core near its external periphery to form the parts of the tire which lie under its tread portion. Thereupon a pair of spinning-rolls by radial motion with respect to the ring core gradually press the canvas in contact with the sides of the ring-core toward its internal periphery to shape the sides of the tire. These spinning-rolls are preferably spring-pressed and their outer periphery or working edge is disk-shaped and rounded so as not to cut the fabric. The spinning-rolls are also radially movable with reference to the ring-core. They have been found peculiarly efficient in shaping the sides of the tire-shoe and form an important feature of my invention. They are sharply differentiated from the hammers or sliding finger devices heretofore proposed for the purpose. So, too, the combination of the tread-forming roll for operating upon the tread portion and the spring-pressed spinning-rolls for shaping the sides of the tire-shoe by radial motion with reference to the ring core forms an effective instrumentality for completely shaping the tire and an important feature of my invention.

In order to prevent the several spiral layers of canvas, which are skim-coated or saturated with rubber, from sticking together while on the stock-roller, I place a strip of plain muslin or the like against the rubber-coated canvas and wind this combination upon the stock-roll. It becomes important, then, when the rubber coated canvas is drawn onto the ring-core from the stock-roll that provision be made for disposing of the muslin which is unwrapped at the same time. To this end I apply as another feature of my invention a take-up roll for the muslin which is driven by frictional contact against the outer surface of the stock-roll.

It is important to secure proper tension on the fabric as this is drawn from the stock-roll onto the ring-core. To this end I cause the fabric to pass over a rubber-covered roll to which some form of tension brake is applied. I have found, also, that the fabric in passing under tension from the stock-roll to the ring-core forms longitudinal creases. These I remove by a stretching-roll supplied with a pair of divergent spirals on its surface.

Without unduly extending this preliminary outline of my invention, I may say that an important feature of my machine

results from the fact that I apply the canvas to the power-driven ring-core while this is moving quite slowly, say at six revolutions a minute. I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at two hundred and seven turns a minute. By this means the machine not only does more work in a given time but it does better work.

I shall now describe, in detail, the machine which constitutes the best embodiment of my invention now known to me.

In the drawings,—Figure 1 is a plan of my device; Fig. 2 is a view in side elevation looking from the right of Fig. 1 with portions in section to illustrate the internal construction thereof; Fig. 3 is a sectional view of the mechanism for supporting and rotating the core; Fig. 4 is a sectional view of the mechanism shown in Fig. 3; Fig. 5 is a view in side elevation of the mechanism for communicating motion to the mechanism shown in Figs. 3 and 4; Fig. 6 is a view in end elevation of the support and tool carriage on which the devices used for manipulating, shaping and smoothing the fabric while being placed on the core are mounted; Fig. 7 is a view in side elevation of a tension regulating device; Fig. 8 is a view, in central section, of a lock employed in this device; Fig. 9 is a plan of a turret on which the mechanisms for manipulating the tire are mounted, also showing the various tools employed in connection with this type of device on a ring-core shaped for clencher tires; Fig. 10 is a sectional view of a standard and reel on which a supply of rubber-coated fabric is mounted; Fig. 11 is a view partly in elevation and partly in section of a chuck on which the core is mounted while the tire is being formed thereon; Figs. 12, 12^a, 12^b, 12^c are cross-sections of a ring-core for inextensible-edge tires with the fabric in different stages of application; Fig. 13 is a diagram of a ring-core used alternately in connection with a pair of stock-rolls on a sliding support; and Fig. 14 is a diagram of a pair of superposed stock-rolls used alternately in connection with a ring-core.

Referring to the drawings in detail, 1 is the base carrying a cylindrically-formed member 3 upon which loosely turns the rotary head 8 by means of a ball-bearing connection 5. The base 8 is provided with a series of pairs of lugs 13, the space between each pair forming a recess to receive a locking member 14 mounted on the side of the cylinder 3 for arresting at predetermined intervals the movement of the head. Extending upwardly from the head 8, as seen in Fig. 1, are two varieties of standards 15, 16. The four standards are L-shaped in cross-section and are positioned with the angles or corners thereof inwardly toward the axis of the cylinder 3. Mounted on these standards 15 and 16 are four complete sets of rolls, and as these sets of rolls are similar, a description of one will be sufficient. Each set of rolls comprises a stock-roll, which constitutes my sheet fabric supply a take-up roll, an idle roll, a rubber-covered tension-roll and a stretching-roll which will now be described. Extending laterally from the standard 15 is an integral arm 24, shown best in Fig. 10, from the outer end of which projects a stub shaft 25 provided with a spring catch 26 for holding a stock-roller 27 on which the supply of rubber-saturated fabric 28 is wound, the successive layers of which are prevented from sticking together by interposing between them a strip of muslin or cloth 29. By releasing the catch 26, the roller 27 may be removed from its shaft 25 and replaced by another roller on which a fresh supply of fabric and cloth is wound whenever the supply on the original roller becomes exhausted.

Mounted on the shelf 17 (Figs. 1 and 2), which extends horizontally across the upper corner or angle of the standards 15, is an upright hanger 18 having a laterally extending arm 19 to the free end of which is pivotally mounted a depending yoke 20 and having mounted on pins in its free ends thereof a roller 23, hereinafter designated as the take-up roller. Below the arm 24 is an idle roller 30 (see Fig. 2) mounted between the standards 15 and 16.

In the front or outer portion of the standards 15, 16 are bearings to receive a shaft on which is mounted a tension roller 36, preferably having its outer face covered with a layer of vulcanized rubber 361, which rubber-coating I have found peculiarly efficient. The tension-roll constitutes a highly important element since it secures the application of the several layers of fabric to the ring-core with a uniform degree of tension. To this end there is mounted on one end of the shaft which bears the tension-roller 36 (Figs. 2 and 7) a disk 42 around which is a friction band 43 having one end anchored to a post 44 on one of the standards and having its other end connected to a rod 45 bearing a tension measuring gage 46 and a turnbuckle 47 at its lower end. The turnbuckle 47 is connected with some fixed support such as the base 8 by means of a second rod 48. If increased tension is desired on the tension-roller 36 the turnbuckle 47 is manipulated so as to cause a contraction of the friction band 43 on the disk 42 to a determined degree, indicated by the gage 46 so that a predetermined amount of resistance will be offered to the turning or movement of the tension-roller 36.

I have found that as the ring-core draws the fabric under tension from the stock-

rolls, the fabric forms troublesome longitudinal creases which must be gotten rid of. The expedient which I have finally hit upon for this purpose consists of a stretching-roll 41, here shown as mounted in a swinging frame 40. The outer surface of the stretching-roller 41 is provided with two spirally arranged sets of grooves both commencing at the longitudinal central line thereof and diverging spirally therefrom to cause it to laterally stretch and smooth the rubber-saturated fabric which is drawn partly around it in its passage from the tension-roller, the effect of the roller being to remove all longitudinal creases and other wrinkles which will be formed in the fabric during the removal of the stock from the stock-roller on its passage to the ring-core. The arms 40 are permitted to swing on bolts and are held in any determined position by tightening nuts. By passing the fabric over the tension-roll and under the stretching-roll, the fabric is in contact with the surfaces of these rolls for a considerable fraction of the circumference.

It will be understood that the stock-roll the idle roll, the tension-roll and the stretching-roll constitute a single set of rolls, there being, in the case shown, four sets or two pairs of sets of rolls in all, one pair of set of rolls coöperating with one ring-core and the other pair of set of rolls coöperating with the other ring-core. Considering the pair of stock-rolls which coöperate with a single ring-core, it is understood that the rubber-coated canvas is applied to the two stock-rolls at alternate angles which means that when the stock rolls coöperate with the ring-core the threads of the fabric from one roll will be at an angle with the direction of the threads of the fabric from the other roll. This is brought about, in the construction which has just been described, by mounting a pair of set of stock-rolls upon the rotary head 8. But the same result could be obtained among numerous other ways by mounting a pair of stock-rolls upon a sliding head, as shown in Fig. 13, or by mounting the stock-rolls one above the other, as shown in Fig. 14 and placing the stock upon the pairs of stock-rolls so that their threads will come at angles to each other when supplied to the ring-core.

The operation of a set of rolls is as follows: In order that the ring-core may take hold of the fabric, the core is coated with rubber or cement. The rubber-coated canvas is now unwound from the stock-roll and carried downwardly under the idle roll 30, and from thence upwardly around the tension-roll 36, and from thence downwardly under and around the stretching-roll 41, and finally onto the power-driven ring-core to which the end of the canvas is made to adhere. Since the ring-core is power-driven at a low speed, the rubber-coated canvas will be drawn outwardly from under the surface of the stretching-roll as well as over the surface of the tension-roll. In this manner the fabric will be smoothed by the stretching-roll and the proper tension will be applied to it by the tension-roll. When one round of canvas has been applied to the ring-core, the length is cut off by the workman's scissors from the portion remaining on the stock-roll. The cloth which is interposed between the layers of the rubber-coated canvas on the stock-roll passes downwardly around the under face of the stock-roll and frome thence upwardly and is then rewound on the take-up roll 23 which, being hung between the arms of the pivoted yoke 20, frictionally rests on the surface of the stock-roll 27, thus receiving motion thereby. During the operation of withdrawing the strip of rubber-coated canvas from the stock-roll, the lug 14 (Fig. 2) will be inserted in the recess between the lugs 13 to prevent the revolution of the head 8.

I have now to describe the source of power for the ring-core. Mounted on the base 1 is a motor 49 having a sprocket wheel 50 driving a sprocket chain 51, passing around a sprocket wheel 52, on a shaft 53, supported by brackets 54. The shaft 53 bears, at its ends, sprocket wheels 55 driving sprocket chains 56, passing around the loose members of clutches 57, which with their coöperating tight members 59 are mounted on shafts 58 (Figs. 3, 4, 5) and are operated by clutch levers 59. Mounted on suitable ways 60 at each end of the base 1 are housings 61. Each of these housings may be provided on its under surface with suitable grooves so as to render them movable on the ways 60 and is held in a determined position by means of bolts 62, the lower ends of which engage in slots 63 formed in the base 1. The housing 61 is hollow and is provided with an opening through which the shaft 58 enters (Fig. 4). Within the housing are a pair of alined brackets provided with bearings bolted to the walls of the housing and supporting one end of the shaft 58. Extending longitudinally of the housing 61 and supported in bearings suitably secured to inturned flanges 69 formed integral with the body of the housing is a shaft 70 near the longitudinal center of which is splined a clutch member 71 having its two lateral faces formed to engage corresponding clutch members 72 and 73 mounted loosely on said shaft 70. The clutch member 72 is provided with a hub 74 rigidly secured to a spiral gear 75 adapted to be driven by means of a worm 76 mounted on the shaft 58 just as the correspouding clutch member 73 has a hub 84 secured to a spiral pinion 83 driven by a worm 82 on a shaft 78. The shaft 78 is driven from the shaft 58 by a

chain and sprocket connection and the arrangement is such that the spiral gear 83 rotates much more rapidly than the spiral gear 75. It will thus be seen that the shafts 58 and 78 are constantly power driven and retating. With them rotate the clutch-members 72 and 73, which are loose on the shaft 70. By throwing the clutch member 71, which is splined on the shaft 70, into connection with either the clutch member 73 or 72, the shaft 70 is made to revolve slowly or rapidly. The movement of the clutch member 71 is effected by the shifting lever 86.

Mounted on the shaft 70 outside of the housing 61 is a gear 88 (Fig. 5) adapted to mesh with a pinion 89 secured to the extended end of a shaft 90, mounted in the upper part of the housing 61 and carrying a locking-disk 93. Coöperating therewith is a spring pressed locking pin 100 held out of engagement with the locking-disk by a cross pin 97 moving in a slot in the casing 95 (Fig. 3). To lock the shaft 90 in a fixed position, the pin 100 is allowed to assume the position shown in Fig. 3. To permit the shaft 90 to rotate, the pin 100 is withdrawn from contact with the locking-disk 93 and held in this withdrawn position by the cross pin 97 which bears against the end of the casing 95, all in a manner readily understood.

I have now to describe the chuck for carrying the ring-core. Mounted on the shaft 90 is a chuck (see Fig. 11) comprising a cup-shaped body portion 101 provided with an internally threaded hub 102 to receive the end of the shaft 90. The interior of the member 101 is further provided with a flange 103 provided with openings 104 in radial alinement with similar openings 105 in the outer face of the chuck. Positioned in these openings 104 and 105 are exteriorly threaded shafts 106 bearing between the flange 103 and the outer wall of the chuck, nuts 107 the exterior faces of which are formed with beveled gear teeth. Secured to the outer wall of the chuck by means of screws 108 is an annular flange or ring 109 extending inwardly from the outer wall of the cup-shaped member a short distance. Mounted in the space inclosed by the ring 109 is a disk 110 provided with a central opening 111 and with a plurality of openings 112 disposed in a circle concentric with the opening 111. The outer edge of the disk 110 is provided with a shoulder to receive the ring 109 for positioning and holding the disk in place. The inner face of the disk is provided with gear teeth adapted to intermesh with the teeth on the nuts 107. Mounted in the flange 103 are keys 113 arranged to enter key-ways 114 extending longitudinally of the shafts 106 for locking them against rotation in unison with the nuts 107. The outer ends of the shafts 106 are preferably beveled to form a sharp edge for a purpose to be hereinafter described. This chuck is adapted to temporarily hold the ring-core on which the tire casing is to be built. The ring-core (Fig. 2) is provided with an inwardly-extending flange 116 having at intervals V-shaped slots 117 to receive the outer ends of shafts 106.

While I have described the mechanism for driving and supporting the ring-core in detail, so that its exact construction may be understood, it will be seen that in its essence I employ a slow-speed mechanism, in this case represented by the clutch member 73, and a fast-speed mechanism, here represented by the clutch member 72, and a speed-changing mechanism, here represented by the clutch member 71 and its shifting lever 86. But when I use the terms fast-speed mechanism, slow-speed mechanism and speed-changing mechanism in the claims, it is understood I mean any class of mechanism accomplishing these functions and not merely the specific mechanism herein shown. Power is thus transmitted from the shafts 50, 53, 58 (Fig. 5) to the shaft 70 (Fig. 4), and in turn to the shaft 90 which, by means of a suitable chuck, carries the ring-core. To mount the ring-core on the chuck, the shifting lever 86 is placed in its intermediate position with the clutch member 71 out of contact with either the fast- or slow-speed mechanism. The locking-stem 100 is now permitted to come into engagement with the locking-disk 93 to hold the shaft 90, which carries the chuck, in an immovable position. This permits the ring-core to be readily placed on the chuck. Thereupon the locking-stem 100 is withdrawn from engagement with the locking-disk 93 and the speed-shifting lever 86 is operated to throw the slow-speed mechanism into action. The ring-core is now rotated at a slow speed. At this time a single layer of rubber-coated fabric is drawn onto the ring-core from the stock-roll. The shifting-lever is now quickly actuated to stop rotation of the core. Thereupon a pair of scissors in the hand of the operator separates the strip of rubber-coated canvas, which is around the core, from the canvas wound on the stock-roll. The speed-changing mechanism is now again actuated to bring the fast-speed mechanism into action. Thereupon the tread-forming and spinning-rolls are brought into play. The supports for these I now proceed to describe.

Slidably mounted on the base 1, substantially below the position occupied by the chuck just described, is a housing 118 comprising a hollow metallic box having outlines approximately concentric with the shaft 90 provided with a depending lug 119 in its lower portion through which extends a screw 120, manipulated by a hand-wheel 121 for shifting the housing 118 toward and away from the ring-core 115, thereby mak-

ing it possible to position and adjust it with respect to the latter when different sized cores are used. The upper portion of the housing 118 is provided with an outwardly-extending dovetailed portion 122 on which is slidably mounted a carriage 123 provided with a depending lug, indicated in dotted lines in Fig. 2, similar to the lug 119, adapted to receive a screw controlled by a hand-wheel 124 for shifting it toward and away from the core.

In the side of the housing 118 immediately below the carriage 123 is a pivoted arm 125 provided with a pin 126 adapted to enter a hole 127 in the side of the housing 118. Depending from the side of the carriage 123 is a lug 128 provided with a pin 129 threaded to permit its adjustment in the lug 128. When the arm 125 is swung upwardly so that the pin 126 is positioned in the hole 127 the pin 129 will engage the arm 125 and arrest further inward motion of the carriage thereby constituting an adjustable stop for accurately limiting the movement of the carriage with respect to the core. The carriage 123 bears an upwardly-extending centrally-placed pin 130 on which is mounted a revoluble head or turret 131 held from displacement by a nut 132. Reference is here directed to Fig. 9. The turret 131 bears a lock 133 exactly similar to the lock shown in Fig. 8, provided with a vertically-shiftable stem the lower end of which is adapted to enter suitable openings 134 in the upper face of the carriage 123 and lock the turret in determinate positions.

The revolving head or turret 131, which is shown simply as a sample of one type of transversely movable support I may employ, bears what for lack of a more suitable name I call the tread-forming-roll 141, the spinning-rolls 147, the cutters 149 and the bead-attaching roll 156, which can be alternately brought into play because of the rotary or transverse movement of the head 131 with respect to the ring-core. These instrumentalities may be juxtaposed to the ring-core, one after the other, by rotating the head. Since the supporting head 131 is radially movable with reference to the ring-core by means of the hand-wheel 124, it follows that each of the instrumentalities mounted thereon is radially movable with respect to the ring-core. In the case of the tread-forming-roll 141, this permits the operator to gradually bring the proper amount of pressure to bear on the canvas either which lies under or which actually forms the tire tread to thoroughly smooth it and shape it to the core. In case of the spinning-rolls 147, the radially movable and in this case sliding support permits the operator to pass the rolls gradually over the surface of the side of the ring-core that is radially with respect to the ring core from the edge of the tread portion to the tire-edge, so as to gradually bring the sheeted fabric which is to form the rubber tire into contact with the sides of the ring-core. In case of the pivoted cutters 149 as well as in the case of the bead-applying roll 156, the radial movability of the support renders it possible to position the parts to the proper place for the work intended with different sized ring-cores.

The tread-forming-roll is mounted in brackets on the radially and transversely movable head 131. Its axis, when in operation, is parallel to the axis of the ring-core and its curvilinear shape in longitudinal section is made to correspond to the shape of the outer or tread portion of the ringe-core. It will thus be clear that after the operator has drawn a layer of rubber-coated canvas onto the ring-core, he can, by pressing the tread-forming-roll 141 against the fabric, smooth and shape the fabric on the core and get it free of captured air bubbles or wrinkles over its outer face. This action will be all the more efficient by reason of revolving the ring-core at high speed.

The spinning-rolls 147 are preferably mounted on ball-bearings or similar anti-friction mechanism for they revolve at high speed and exert considerable pressure on the fabric. They are laterally movable, that is to say they are movable toward and away from the plane of the ring-core and this movability I effect, in the case shown, by pivoting them at 146 on arms 144 mounted on pivots 143 on the head 131 A pair of grips or hand holds 142 on the arms 144 enables the operator to force the rolls 147 apart both when they are first applied to the ring-core and when they are withdrawn therefrom, in the backward motion, after their work is finished. The spinning-rolls are also shown as spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, strong spiral springs will be used. These springs exert the pressure against the fabric for forming it against the sides of the core which would be exerted by the arm of the workman in case of a hand-tool or a hand-pressed roll. In consequence the work of these spring-pressed spinning-rolls is far more even and more rapid than in the case of a roll pressed against the core by hand. And it is of course understood that there may be substituted for the springs and as an equivalent therefor the more cumbersome device of a weight constantly tending to force the spinning-rolls, with considerable pressure, toward the ring-core. When then I say the spinning-rolls or their supports are laterally spring-pressed, I mean either spring or weight pressed laterally against the ring

core for; as before stated, a spring is the equivalent of a weight. In a broader aspect of my invention, however, I may employ mechanical instrumentalities, not the hands of the operator, other than springs or weights for pressing the spinning-rolls laterally against the ring-core. I shall, then, use the term "power-pressed" to cover generally not only springs and weights but other mechanical instrumentalities for pressing the spinning-rolls against the ring-core. When I refer to my spinning-rolls as laterally yielding and no more, I mean to include any source of power for pressing the spinning-rolls against the ring-core, even the comparatively inefficient and irregular power contained in the hands of the operator. While I have shown these spinning-rolls as disk-shaped throughout, it will naturally be understood that the disk-like or narrow character of the rolls is only essential at the periphery which is rounded and not sharp so as not to cut the fabric. By having the outer or working edge of the spinning-roll of a narrow or disk-shape or bead form, it follows that this working edge can effectually contact with the fabric at all portions along the sides of the ring-core. This would be impossible with a roller of the type shown at 141. On the other hand, the spinning-rolls are not so well adapted as the rolls 141 to shape the tread portion of the tire. It will be noted finally that I mount the spinning-rolls with their plane not at a right angle to but to recede at an acute angle from the plane of the ring-core. The fact is when the ring-core is rotating at high-speed, the centrifugal force tends to throw the fabric out at a right angle from the core-plane and unless the roller recedes in the manner shown, the fabric will become entangled with it. Besides the spinning-rolls, when mounted in this way, are found to have a better forming action on the fabric.

The action of the pivoted cutters 149 will be understood without much description. They are brought into position by turning the head 131 and forced together at the proper time to trim the edges of the fabric which has been applied to the ring-core.

The bead-applying rolls 156, 158 are mounted on the arms 155 which swing on the arms 154. The ordinary bead, such as is used in forming a clencher tire, being put into place on one or more layers of fabric which have already been applied to the ring-core, the rolls 156, 158 are swung into place and press the bead firmly into position as the ring-core rotates.

I have shown in Fig. 9 the type of ring-core which will be used for clencher tires. But, clearly, my machine can also be used to make tire-shoes of the inextensible-edge type. To this end I use a collapsible ring-core, the shape of which in cross-section is shown in Figs. 12, 12^a, 12^b and 12^c. The fabric in the several stages of application is also shown in these several figures. The ring-core has two lateral grooves which furnish lodgment for the heavy inextensible edge which is employed in this class of tires. It will be understood that one or more layers of fabric are applied to the ring-core, that the inextensible selvages are then placed into the lateral grooves by hand and that the outer layers or plies of fabric are finally applied over the inextensible selvage. In this case the pivoted cutter 149 may be replaced by a knife in the hands of the workman, since the edge of the lateral groove will act as a guide and that the bead-applying rolls 156, 158 are dispensed with. The tread-forming-rolls 141 and the spinning-rolls 147 are alone used.

Before describing the operation of the device, attention is directed to the fact that the machine is so constructed that there are two cores on which separate workmen can simultaneously work and place fabric, these being placed diametrically opposite to each other, as shown in Fig. 1, and each core is provided with its appropriate mechanism all driven from the same source of power.

The operation of my machine will now be reasonably clear. As I have before explained, a ring-core supplied with some adhesive material on its exterior portion is placed upon the chuck while the speed-shifting lever is in position to hold the speed-mechanism out of action. Thereupon, by properly rotating and locking the rotary support for the stock-rollers, a given stock-roll is brought opposite to the ring-core and the end of the fabric thereon is pasted against the ring-core. The slow-speed mechanism being now brought into action, the ring-core slowly rotates, making a single turn in about ten seconds, drawing the rubber-coated fabric from off the stock-roll and around the tension and stretching-rolls. It results that one round of fabric is now applied under uniform tension to the ring-core. Thereupon the speed gear is put out of action, the ring-core stops moving, and the operator cuts the rubber-coated fabric across to separate the round of fabric which is on the ring-core from the fabric which yet remains on the stock-roll.

The fast-speed mechanism is now brought into play. The tread-forming-roll 141 is then brought into action to shape and smooth the tread-portion of the fabric against the outer periphery of the ring-core. The proper pressure is applied to the tread-forming-roll 141 by the devices which make it radially movable, that is by the hand-wheel 124 which radially moves the carriage 121 and 131. The parts of the tire which will ultimately lie under the tread having

been shaped and the fast-speed gears still being kept in action, the carriage 131 is rotated to juxtapose the spring pressed spinning-roll 147 to the ring-core. The operator forces these rolls apart against the action of the springs. At first the spinning-rolls are positioned to act upon the edges of the tread portion of the tire-shoe. But they are gradually moved radially by the operator by operating the hand-wheel 124 so that they pass over the side portions of the tire-shoe as illustrated in Figs. 12^a, 12^b and Fig. 9. Thus the entire tire-shoe is gradually shaped to the ring-core. The operator now forces the spinning-rolls apart and operates the wheel 124 in the reverse direction to withdraw them from reach of the ring-core but without touching the fabric in this reverse motion.

A single layer of canvas having been applied to and smoothed and shaped upon the ring-core, it will be obvious that the operator will bring the slow-speed mechanism into action, that he will now take his rubber-coated fabric from a second stock-roll and will apply this upon the layer of fabric already on the ring-core in precisely the same way as the first layer of fabric was applied to the ring-core itself. But, by the provision of the two stock-rolls having the rubber-coated canvas thereon constituted of strips cut on the bias, it will be plain that it will be easy to arrange matters so as to have the threads of the canvas layer first applied at an angle to the threads of the canvas layer next applied. This is necessary to make the best type of tire. Two or more layers of canvas having been applied, the cutter may be brought into action to trim the edges of the tire. Thereupon the bead is put in place and the bead-applying rolls are brought into action. Finally, several more layers of fabric with their threads crossed are applied to the ring-core, precisely as in the case of the layers originally applied.

I may say in conclusion that whereas an operator can make seven or eight tires a day by hand, he can make from forty to sixty a day by my machine and make them better than they can be made by hand.

I claim,—

1. An open tire-shoe making machine comprising the combination of a power-driven ring-core, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles for alternate application to the core, substantially as described.

2. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a transversely movable support, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles mounted on the support for alternate juxtaposition to the ring-core, substantially as described.

3. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a rotary support, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles, mounted on the support for alternate juxtaposition to the core, substantially as described.

4. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

5. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

6. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disk-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

7. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disk-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

8. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially movable thread-forming-roll for shaping the outer portion of the tire, a radially moving support laterally spring-pressed against the core, and a spinning-roll mounted on the support to pass radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

9. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core and a transversely and radially movable support carrying a thread-forming-roll for shaping the outer portion of the tire and a laterally yielding spinning-roll for passing radially over the sides of the tire-shoe to

shape the sheeted fabric on the core, which rolls are alternately juxtaposed to the ring-core, substantially as described.

10. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, and a radially movable, rotary support carrying a tread-forming-roll for shaping the outer portion of the tire-shoe and a laterally yielding spinning-roll for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

11. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a forming-roll, a fast-speed mechanism for actuating the ring-core during the operation of the forming-roll, and speed-changing mechanism, substantially as described.

12. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving spinning-roll for passing radially over the side of the tire-shoe to shape the fabric on the core, fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

13. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving support laterally power-pressed against the ring-core, a spinning-roll mounted on the support at a receding angle to the ring-core to pass over the side of the tire-shoe to shape the fabric on the core, a fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

14. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially and transversely movable support, a tread-forming-roll and a laterally yielding spinning-roll for passing radially over the sides of the tire-shoe mounted thereon, fast-speed mechanism for actuating the ring-core during the operation of the tread-forming and spinning-rolls, and speed-changing mechanism, substantially as described.

15. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying a spiral winding of rubber-coated fabric and muslin, or the like, and a yieldingly mounted take-up roll frictionally engaging the material on the stock-roll, whereby the muslin is taken up as the rubber-coated fabric is drawn onto the ring-core, substantially as described.

16. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a tension-roll, a power-driven ring-core for drawing the sheeted fabric under tension from the stock-roll, and a stretching-roll provided with divergent, spirally arranged sets of grooves between the tension roll and the ring-core, whereby the longitudinal creases are taken out of the fabric in its passage to the ring-core, substantially as described.

17. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a tension device, a power-driven ring-core for drawing the fabric under tension from the stock-roll, and a stretching-roll between the tension device and ring-core, whereby the longitudinal creases are taken out of the fabric and it is smoothly and evenly applied to the ring-core, substantially as described.

18. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising the stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, and a tension-roll over which the fabric passes on its way to the core, substantially as described.

19. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising a stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, and a stretching-roll provided with divergent, spirally arranged sets of grooves over which the fabric passes on its way to the core, substantially as described.

20. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head and two sets of rolls for alternate juxtaposition to the core, each set comprising a stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, a tension-roll and a stretching-roll over which the fabric passes on its way to the core, substantially as described.

21. An open tire-shoe making machine comprising the combination of two power-driven ring-cores, a rotary head, a pair of stock-rolls mounted thereon for alternate juxtaposition to one core carrying sheeted fabric with their threads at alternate angles, and another pair of stock-rolls mounted on

the head for alternate juxtaposition to the other core also carrying sheeted fabric with their threads at alternate angles, substantially as described.

22. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

23. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

24. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll having a rounded, disk-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric, on the core, substantially as described.

25. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll having a rounded disk-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

26. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core for drawing the sheet-fabric from the source of supply in a flat condition, a radially sliding support, and a laterally yielding spinning-roll on the support for passing radially along the sides of the ring-core to curve and shape the sheeted fabric thereon, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILL C. STATE.

Witnesses:

R. M. LEMIEUX,

O. W. MYERS.

Plaintiff's Exhibit No. 3—Patent on Defendant's Machine.
(Thropp & De Laski No. 1,119,326.)

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

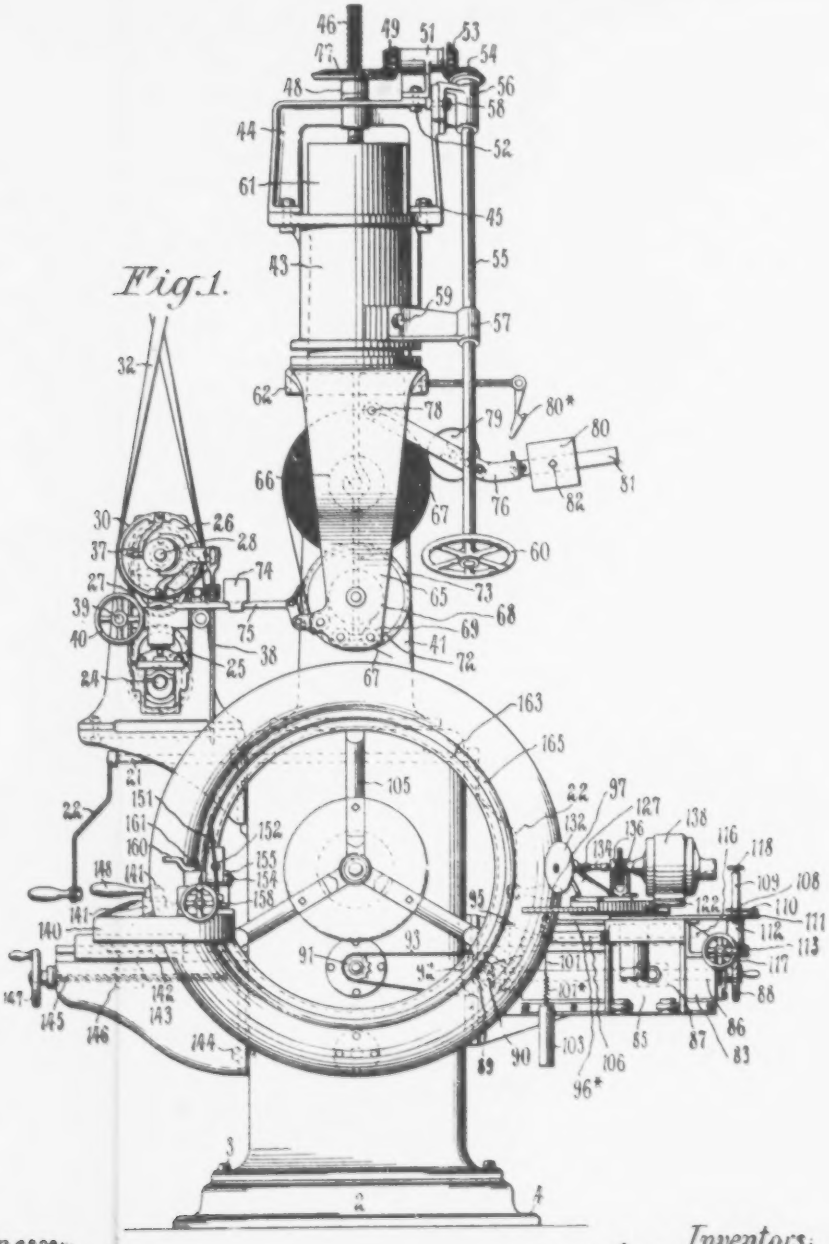
APPLICATION FILED JAN. 24, 1912.

1,119,326.

Patented Dec. 1, 1914.

7 SHEETS-SHEET 1.

Fig. 1.



Witnesses:

Inventors:

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

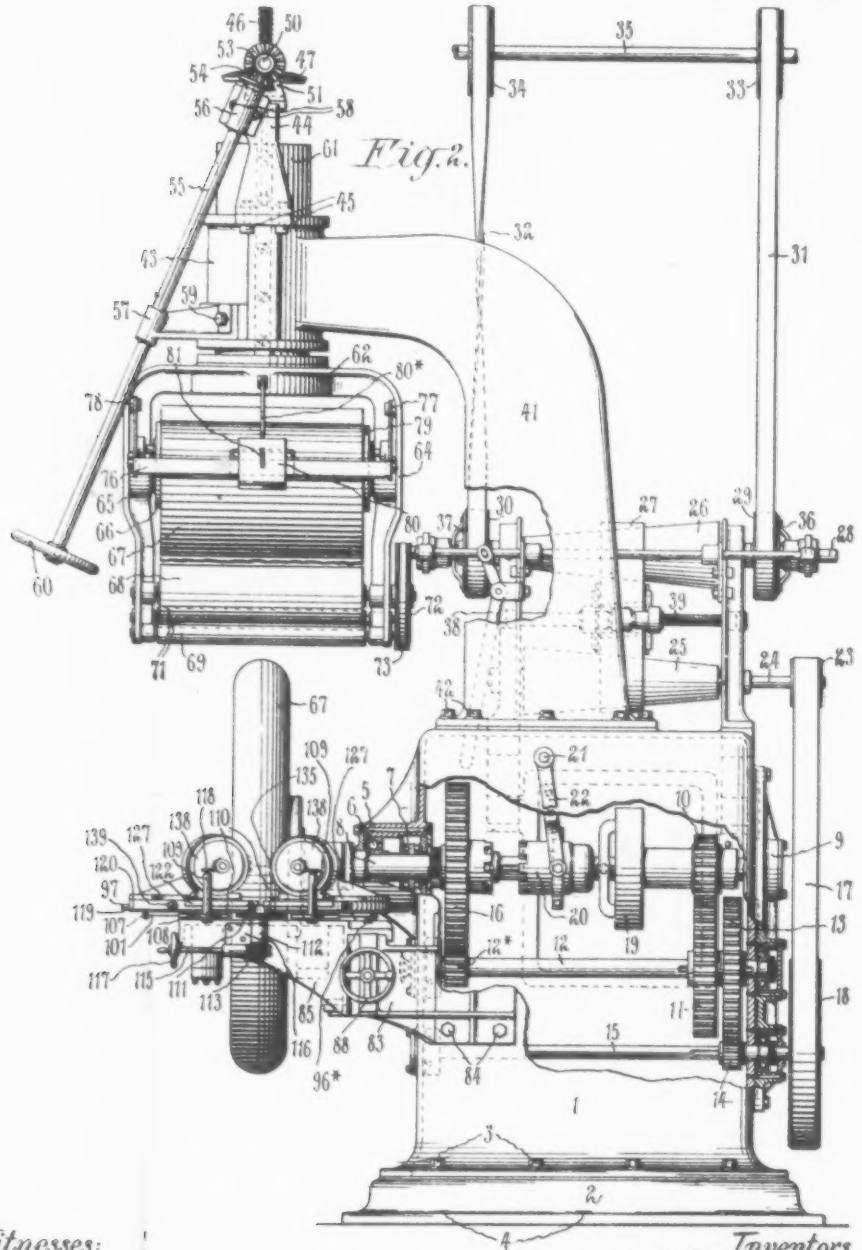
APPLICATION FILED JAN. 24, 1912.

1,119,326.

Patented Dec. 1, 1914.

7 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
Harry J. Klusher
F. George Barry

Inventors
John E. Thropp, P. D. Thropp
and Albert de Laski
by their attorney
Brown & Sumner

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

APPLICATION FILED JAN. 24, 1913.

1,119,326.

Patented Dec. 1, 1914.

7 SHEETS—SHEET 3.

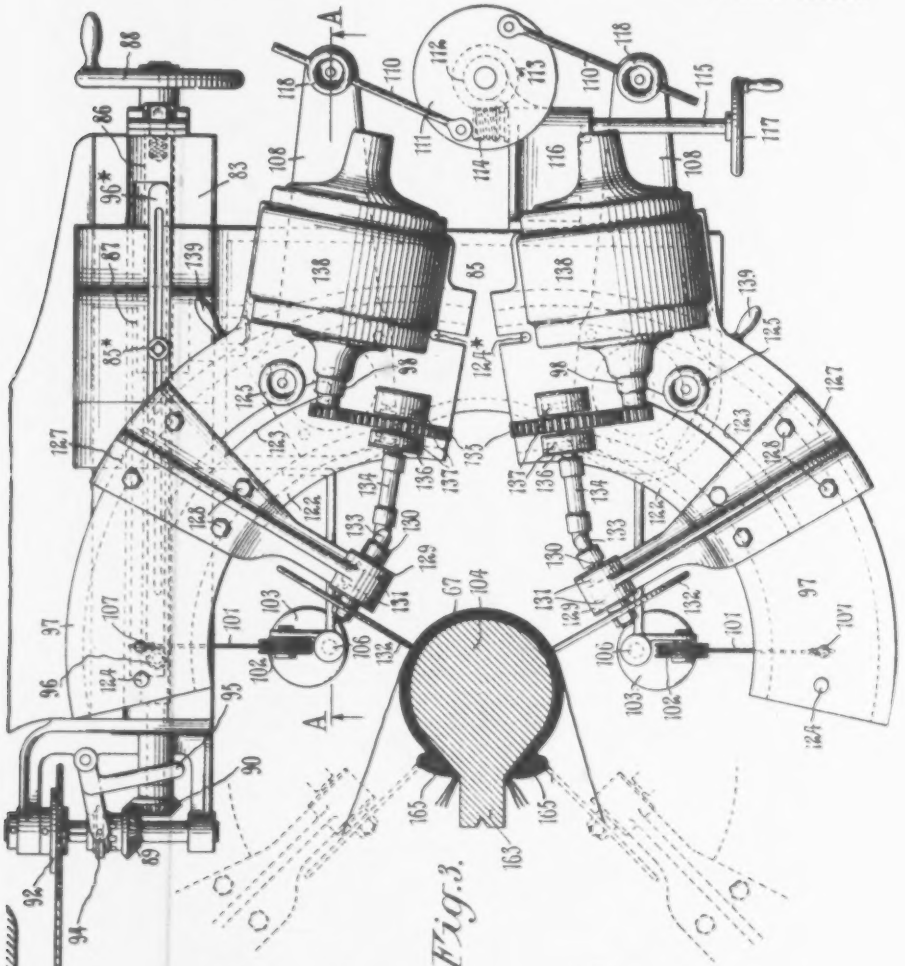


Fig. 3.

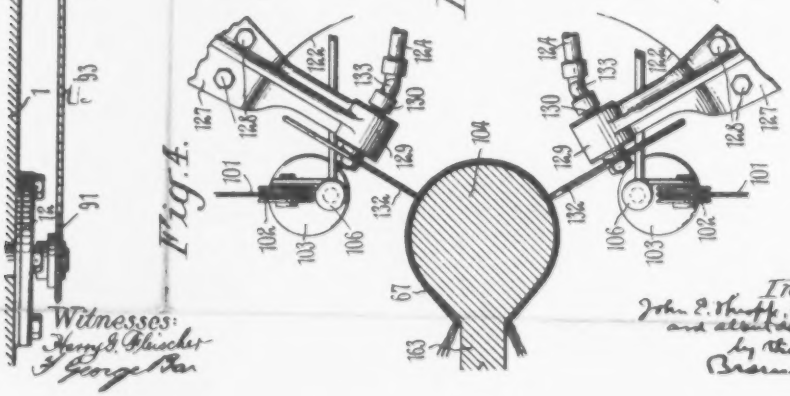


Fig. 4.

Witnesses:
Henry J. Bleicher
F. George Par

Inventors:
John E. Thropp, Otis D. Thropp
and Alexander De Laski.
by their attorneys
Brown & Seward

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

APPLICATION FILED JAN. 24, 1913.

1,119,326. Patented Dec. 1, 1914.

7 SHEETS—SHEET 4.

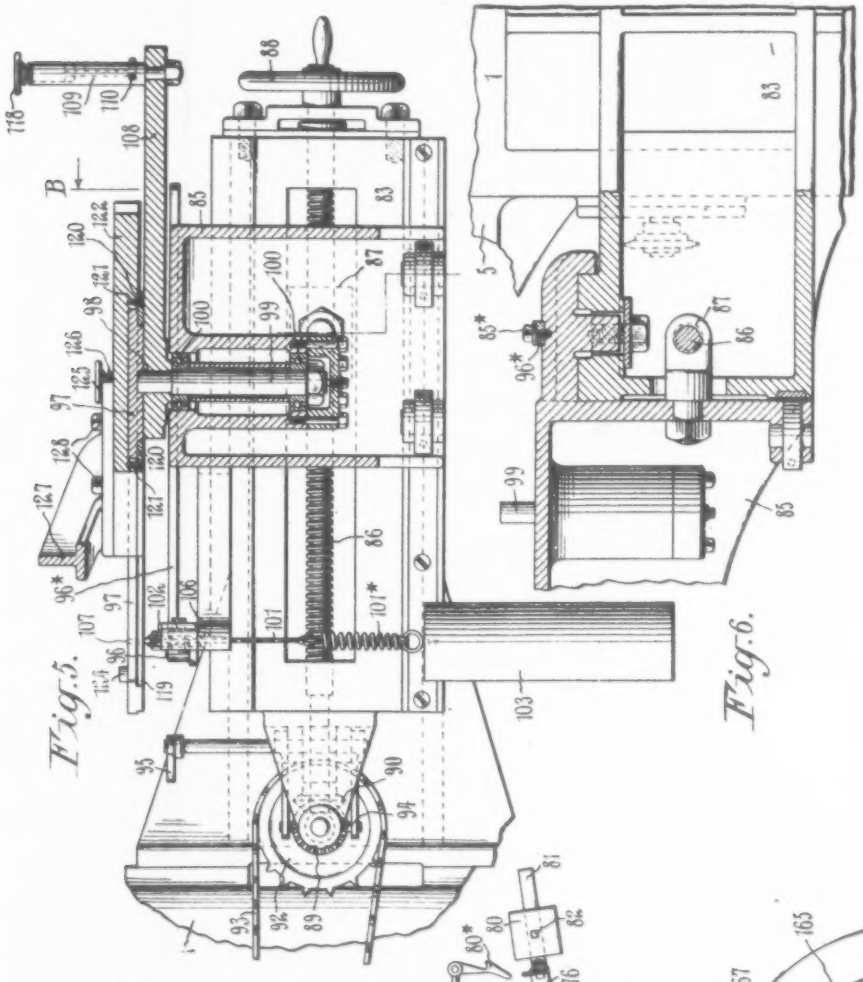


Fig. 5.

Fig. 6.

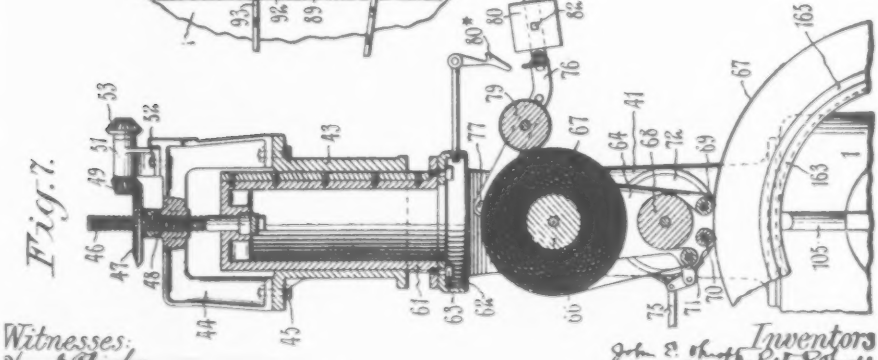


Fig. 7.

Witnesses:
Harry B. Fleischer
F. George Kaiser

Inventors:
John E. Thropp, Peter D. Thropp and Albert de Laski,
by their attorneys
Brown & Seward

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

APPLICATION FILED JAN. 24, 1912.

1,119,326.

Patented Dec. 1, 1914.

7 SHEETS—SHEET 5.

Fig. 8.

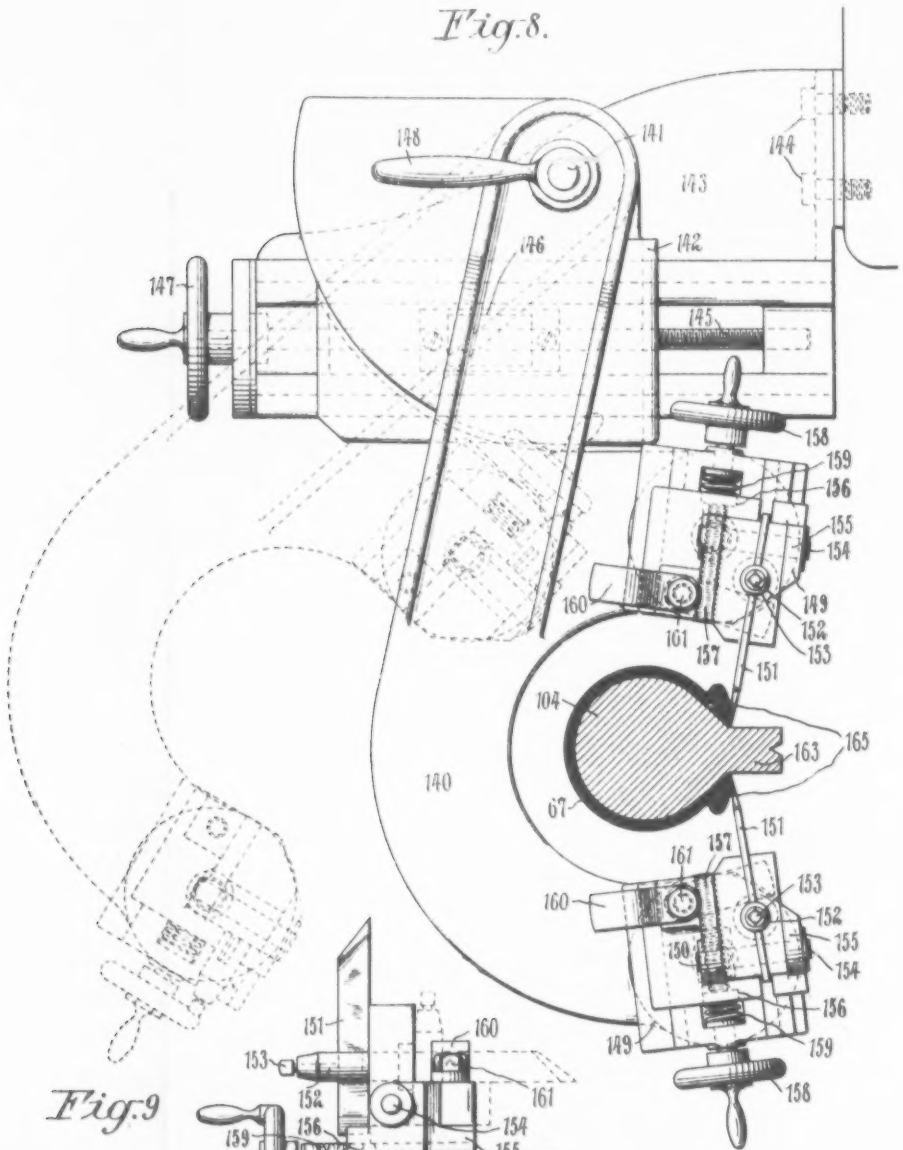


Fig. 9

Witnesses:
Henry J. Fleischer
L. George Berry

Inventors:
John E. Thropp, Peter D. Thropp
and Albert de Laski
by their attorneys
Brown & Seward

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

APPLICATION FILED JAN. 24, 1913.

1,119,326

Patented Dec. 1, 1914.

7 SHEETS-SHEET 6.

Fig. 10.

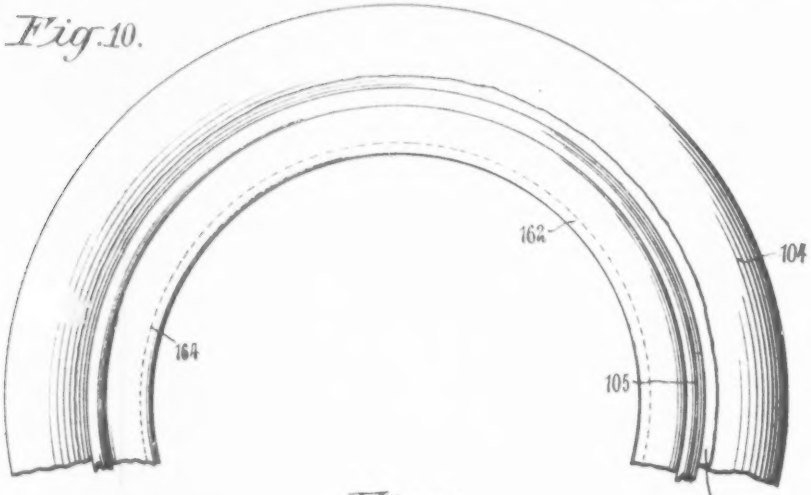


Fig. 11.

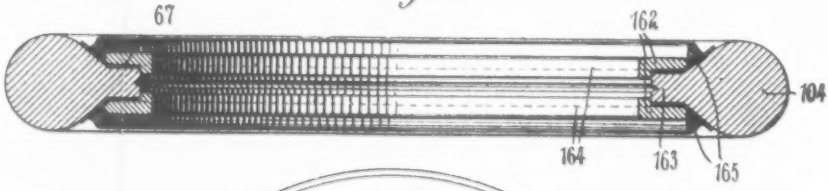


Fig. 12.

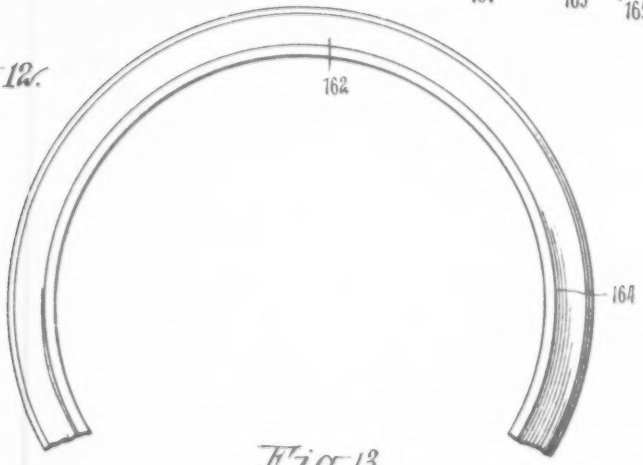
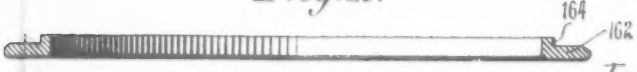


Fig. 13.



Witnesses:
Harry B. Rauscher
F. George Kenny

Inventors:
John E. Thropp, Peter D. Thropp
and Albert de Laski
by their attorneys
Brown & Seward

J. E. & P. D. THROPP & A. DE LASKI.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

APPLICATION FILED JAN. 24, 1912.

1,119,326. Patented Dec. 1, 1914.

7 SHEETS-SHEET 7.

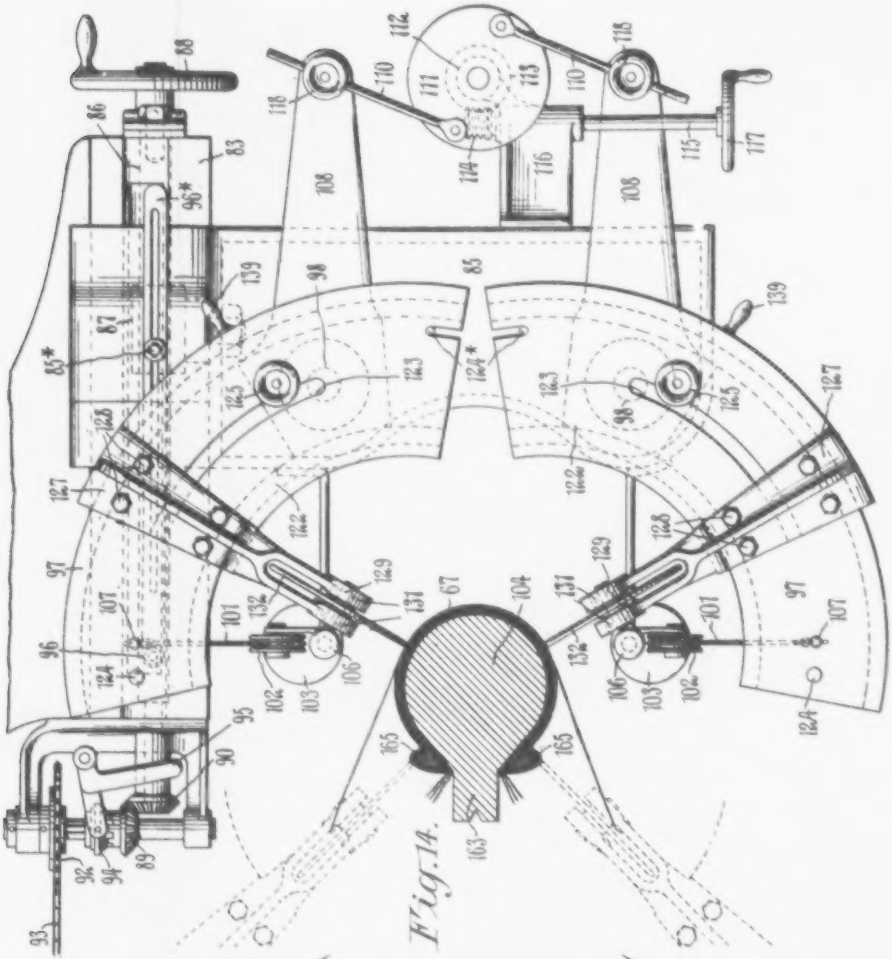


Fig. 14.

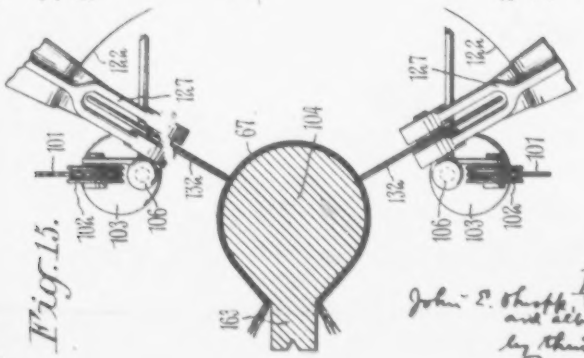


Fig. 15.

Witnesses:
Henry J. Klausler
A. George Berry

Inventors:
John E. Thropp, Peter D. Thropp
and Albert de Laski
by their attorneys
Brown & Brown

UNITED STATES PATENT OFFICE.

JOHN E. THROPP AND PETER D. THROPP, OF TRENTON, AND ALBERT DE LASKI, OF WEEHAWKEN, NEW JERSEY, ASSIGNORS TO THE DE LASKI AND THROPP CIRCULAR WOVEN TIRE COMPANY, OF TRENTON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MACHINE FOR MAKING OR BUILDING UP PNEUMATIC TIRES.

1,119,326. Specification of Letters Patent. Patented Dec. 1, 1914.

Application filed January 24, 1912. Serial No. 673,069.

To all whom it may concern:

Be it known that we, JOHN E. THROPP, PETER D. THROPP, and ALBERT DE LASKI, citizens of the United States, said JOHN E. THROPP and PETER D. THROPP being residents of Trenton, in the county of Mercer and State of New Jersey, and said ALBERT DE LASKI being a resident of Weehawken, in the county of Hudson and State of New Jersey, have invented a new and useful Machine for Making or Building Up Pneumatic Tires, of which the following is a specification.

This invention relates to a machine for making or building up pneumatic tires, and more particularly to making so-called shoes or casings for covering the inner tube in the type of pneumatic tires known as the double tube variety.

Among the objects of this invention are to provide a machine of this character which may be readily manipulated by one operative, which will make tires much more rapidly and much more uniformly than they can be made by hand, and which will occupy a minimum of floor space.

Other objects are to provide certain improvements in the form, construction and arrangement of the several parts whereby the greatest known perfection of tire building is attainable, and the above mentioned objects effectively carried out.

A practical embodiment of our invention is represented in the accompanying drawings, in which—

Figure 1 represents a front view of the entire apparatus, Fig. 2 represents a side view thereof, parts being broken away, Fig. 3 represents a detail plan view of the devices for forming the fabric about the core, the latter being shown in section, Fig. 4 represents a detail view showing the devices for forming the fabric layers, acting upon the first plies of the same, Fig. 5 represents an enlarged detail section taken in the plane of the line A—A of Fig. 3, looking in the direction of the arrows, Fig. 6 represents a detail section taken in the plane of the line B of Fig. 5 looking in the direction of the arrow, Fig. 7 represents a detail vertical section showing the head, supply roll and adjacent parts, Fig. 8 represents an enlarged detail plan view showing the cutters for trimming the edges of the material, the core being shown in section, Fig. 9 represents a detail side elevation of one of the cutting devices, parts being broken away, Fig. 10 represents a side elevation, partly broken away, showing the bead core placing ring on the core, Fig. 11 represents a section through the parts shown in Fig. 10, Fig. 12 represents a side view partly broken away of the bead placing ring, Fig. 13 represents a section therethrough, Fig. 14 represents a view similar to Fig. 3, showing a modified form of forming rolls, and Fig. 15 represents a view similar to Fig. 4, showing a modified form of forming rolls.

The apparatus comprises a casing denoted by 1, which is secured to a suitable base 2 by bolts 3, which base 2 may, in turn, be secured at any desired place by fastening devices passing through holes 4. This casing 1 is provided at one side with a suitable boss 5 fitted with ball bearings 6 and thrust bearings 7 in which is journaled a rotatable shaft 8, the inner end of which shaft extends through the casing and is journaled in the other side thereof at 9, while the outer end projects therefrom and is fitted to receive the core upon which the tire is to be built, as will be hereinafter described.

The shaft 8 is provided with a spur gear 10 rotatably mounted thereon, which spur gear 10 is fitted to engage a spur gear 11 mounted against rotation on the jack shaft 12 journaled in the casing 1 below the shaft 8, and which shaft 12 also carries a spur gear 13 mounted against rotation thereon and fitted to engage a pinion 14 mounted against rotation on a power driven shaft 15 journaled in the casing 1 below the shaft 12. The jack shaft 12 is provided at its front end with a pinion 12* mounted against rotation thereon and fitted to engage a large gear 16 rotatably mounted on the shaft 8. The shaft 15 is positively driven through the belt 17 which engages the pulley 18 secured against rotation to the end of the shaft 15, and which belt 17 is itself driven from a suitable source of power, as will be hereinafter fully described. Mounted against rotation on the shaft 8 intermediate the gear 10 and gear 16 is a friction cone

clutch 19 and a jaw clutch 20 arranged to be operated from a cross shaft 21 to which is secured a pair of handles 22 for convenient manipulation thereof.

When the friction clutch 19 is thrown into locking position, it holds the small gear 10 against rotation on the shaft 8 and the said shaft will consequently be driven at a relatively high speed through the driven shaft 15 and the train of gears 14, 13, 11, 10. When the jaw clutch 20 is thrown into locking position, the large gear 16 will be fixed against rotation on the shaft 8 and the latter will be driven at a relatively slow speed through the driven shaft 15 and the train of gears 14, 13, 12*, 16. When the shaft 8 is driven at relatively high speed as first mentioned, the large gear 16 will rotate idly on the shaft 8; and when the shaft 8 is driven at low speed the small gear 10 will rotate idly thereon. The handles 22 may be thrown in such a position that neither clutch is in locking engagement, in which case the gears 10 and 16 will be idly rotated on the shaft 8 while the latter remains still. The belt 17 also engages a small pulley 23 mounted against rotation on a shaft 24, which shaft carries a variable cone 25 which itself is driven from a steady speed cone 26 by a sliding belt 27. The steady speed cone 26 is mounted on a shaft 28 which is provided at either end with pulleys 29, 30, which pulleys are connected by means of a straight belt 31 and crossed belt 32, respectively, to pulleys 33, 34, fixed on a shaft 35 driven from a suitable source of power, not shown. A pair of clutches 36, 37, are mounted on the shaft 28 and arranged to be operated by a lever 38 so as to throw either the pulley 29 or the pulley 30 into driving engagement with the steady speed cone 26. When the pulley 29 is in driving engagement with the cone 26, the latter is driven in one direction, and when the pulley 30 is in locking engagement with the said cone it is driven in the reverse direction owing to the crossing of the belt 32.

A rod 39 has a screw and nut engagement with the belt 27, and is provided with a hand wheel 40 for sliding the belt 27 in either direction on the cones 25 and 26 for varying the speed of the cone 25 and hence varying the speed of the driven shaft 15 in the casing 1.

From the above described arrangement of belts, pulleys, cones, shafts, clutches, and gears, it will be seen that the shaft 8 can be rotated in either direction and at varying speeds. It will also be seen that with a certain fixed speed for the driven shaft 15, the shaft 8 may be rotated either forward or backward at a high and a low speed. Thus there is provided suitable arrangements for adapting the rotation of the shaft 8 both in direction and speed to the most precise demands of any part of the operation of building the tire.

The apparatus also includes mechanism for supplying material of which the tire is to be constructed to the core upon which the latter is to be formed, which mechanism, as shown in the drawings, comprises an overhanging stanchion 41 firmly secured to the top of the casing 1 by bolts 42. This stanchion 41 has a hollow cylindrical head 43 vertically disposed directly above the core to be hereinafter described. This head 43 has a frame support 44 of inverted U-shape secured to the top of the head by bolts 45, which frame 44 has a centrally disposed vertical hole fitted to receive a screw 46. This screw 46 has a screw threaded engagement with a miter gear 47 supported on top of the frame 44 by an interposed thrust bearing 48, which miter gear 47 is in engagement with a miter pinion 49 secured to one end of a short transverse shaft 50 horizontally journaled in a support 51 bolted to the top of the frame 44 as at 52. A second miter pinion 53 is secured to the other end of the shaft 50, and it, in turn, is in engagement with a third miter pinion 54 secured to the upper end of a rod 55. This rod 55 is rotatably mounted in a pair of brackets 56, 57, fastened to the side of the frame 44 and the hollow head 43 by bolts 58 and 59 respectively; and is provided with a hand wheel 60 fixed to its lower end for convenient manipulation by the operative.

A hollow cylinder 61 is fitted to reciprocate vertically in the head 43 and is secured at its upper end to the screw 46. To the lower end of this cylinder 61 is fastened a frame 62 by means of screws 63, which frame 62 has a pair of downwardly extending arms 64, 65. The arms 64 and 65 have suitable bearing supports for the stock roll 66, which is arranged to carry the fabric 67 from which the tire is to be constructed; the friction or resistance roll 68 and guide rollers 69, 70, 71. The friction roll 68 is preferably composed of some material which has a surface of such a nature as to cause considerable friction between it and the fabric of which the tire is to be composed, wood being found very suitable for this purpose. The guide rollers 69, 70, 71, are preferably composed of metal, such as steel, and are so located that the distance between the axes of any two of them is less than the diameter of the resistance roll 68.

The resistance roll 68 is provided at one end with an enlarged drum 72 fitted with a brake band 73 which is arranged to be caused to grip the drum 72 with varying degrees of friction by means of the weight 74 slidably mounted upon the notched bar 75.

A rocking frame 76 is pivoted to the arms 64 and 65 of the frame 62 at 77 and 78, re-

spectively, in which rocking frame is suitably journaled a take-up roll 79 adapted to receive the cloth which is commonly wound on the stock roll 66 with the tire fabric 67. This take-up roll 79 is caused to engage the fabric 67 on the roll 66 with varying degrees of friction by means of the weight 80 which is slidably mounted on a rod 81 secured to the outer edge of the rocking frame 76, and arranged to be fastened at various positions along the rod 81 by a set screw 82. A hook 80* is located above the frame 76 and arranged to engage the latter when it is swung upwardly for the purpose of holding the roll 79 out of engagement with the fabric 67 on the stock roll 66. The frictional engagement of the take-up roll 79 with the stock roll 66 causes the former to be rotated by the latter and hence to take up the cloth as the fabric is unwound from the roll 66.

The parts just described as being mounted in the frame 62 are arranged to be vertically adjusted as a whole through the engagement of the frame 62 with the cylinder 61, which, in turn, is secured to the screw 46. It will be seen, from the description, that by rotating the hand wheel 60, the miter gear 47 will be turned upon the screw 46 and will either raise the latter or lower it, owing to the well known action of the screw and nut principle. This raising and lowering of the screw 46 will carry the frame 62 and all its appurtenances with it. While we have shown a manually operated screw and nut for the purpose of adjusting these parts, we do not at all intend to limit the structure to such a mechanical arrangement as any well known means for effecting this result either by hand or by power is perfectly suitable for the purpose.

The machine also includes apparatus for mechanically building or forming the tire material onto the core and this apparatus, in the form shown in the drawings, comprises a laterally extending bracket 83 which is firmly secured to the casing 1 by bolts 84.

A laterally extending carriage 85 is mounted on the bracket 83 to slide transversely along the front of the casing 1. This sliding movement of the carriage 85 is effected by a screw 86 which is threaded into a nut 87 in the carriage 85, and which screw 86 is adapted to be rotated manually by a hand wheel 88 and mechanically by miter gears 89 and 90 driven from the shaft 12 through sprockets 91 and 92, chain 93, and clutch 94. The clutch 94 is provided with a knock-off 95 so located as to be engaged by a roller 96 rigidly secured on the end of a slide 96*, which slide has a pin and slot engagement with a set screw 85* on the carriage 85, for securing the said slide in any desired longitudinal adjustment. The engagement of the roller 96 with the knock-off 95 may be so timed that the clutch 94 will be disengaged from the miter gear 89 and hence the screw 86 cease to be power driven at any desired point in the movement of the carriage 85. It will be understood that the carriage 85 may be reciprocated at any point by the manual operation of the hand wheel 88. A pair of similar curved arms 97 are fulcrumed at 98 in the carriage 85 by pivots 99 mounted in suitable ball bearings 100 as clearly shown in Fig. 5. The arms 97 are secured by means of cords 101 passing over pulleys 102 to weights 103, which weights tend to draw the arms 97 toward each other and hence toward the core 104 upon which the tire is to be built; which core is supported by an adjustable spider 105 fixed against rotation on the protruding end of the shaft 8 whereby the core 104 is caused to rotate with and at the speed of the shaft 8. If desired, coil springs 101* may be secured to the cords 101 and weights 103 to obviate any jerkiness in the action of the said weights.

The pulleys 102 are mounted on brackets 106 at a distance from the fulcrum points 98 of the arms 97 substantially equal to the distances from the said fulcrum points to the points 107 at which the ends of the cords 101 are secured to the arms 97, thus insuring that the weights will have substantially the same pull on the arms throughout the swing of the latter about their fulcrums.

The arms 97 are each provided with a rearward extension 108, which extensions in turn have at their extremities standposts 109 provided with transverse holes fitted to receive connecting rods 110 secured, at diametrically opposite points, to a circular disk 111 which has a hub 112 provided with a worm gear 113 fitted to engage a worm 114 fixed to the end of a transverse rod 115 journaled in a lug 116 on the carriage 85, and provided at its outer end with a hand wheel 117 for manual operation. The standposts 109 are interiorly screw threaded for engagement with set screws 118 fitted to engage the connecting rods 110 for locking them in any desired position in the standposts 109.

The arrangement of parts just described permits the operator to lock the connecting rods 110 in the standposts 109 by means of the set screws 118, and then by manually operating the hand wheel 117 swing the arms 97 about their fulcrum points 98 in either direction. The advantage of this structure will be fully described in setting forth the operation of the machine.

The curved arms 97 are undercut as clearly shown at 119, Fig. 5, whereby they are fitted to receive curved plates 120 secured by means of screws 121 to the curved

slides 122 mounted to oscillate arcuately on the curved arms 97. These slides 122 are provided with curved slots 123 fitted to receive the pins 124 which are adapted to abut against the inner ends of the slots 123 when the slides 122 have been swung to the limit of their outward movement, thus preventing further movement of the said slides 122, while pins 124* limit their inward movement. The slides 122 are further provided with set screws 125 which are arranged to be screwed down against the tops of the arms 97 for locking the slides 122 in any position on the said arms. These set screws 125 may be provided with locking springs 126 for preventing the accidental loosening of the said set screws.

Bracket arms 127 are securely fastened to the outer ends of the curved slides 122 by screw bolts 128, and extend inwardly in substantially a radial direction from the said plates. The bracket arms 127 terminate in hollow heads 129 in which are journaled shafts 130 by means of suitable ball bearings 131, which shafts 130 are provided on their outer ends with disk shaped forming rolls 132 secured against rotation thereon. These disk-shaped forming rolls 132 are so mounted that their operating face or edge, which is adapted to engage the material on the core, is at the center of the circle through an arc of which the slides 122 are mounted to oscillate, thereby permitting the slides 122 to be moved and the angle of engagement of the disk rolls 132 with the material on the core to be varied, without moving the operative face of the said rolls. The shafts 130 are connected by means of universal joints 133, shafts 134 and trains of gears 135, partly supported by brackets 136 mounted on the slides 122 and having suitable ball bearings 137, with electric motors 138 also mounted on the curved slides 122 and arranged to be supplied with electricity from any convenient source.

The slides 122 may be provided with handles 139 for the convenient manual sliding thereof. The curved arms 97 carrying the slides 122, brackets 127 and forming rollers 132, are so positioned with respect to the core 104 that the forming rolls 132 will engage the said core considerably before the arms 97 have swung about their fulcrum points 98 to the limit of their inward movement.

The machine also includes mechanism for cutting or trimming off the superfluous edges of the tire material after it has been formed on the core 104, which mechanism comprises a horizontally disposed swinging arm 140 pivoted at 141 to a plate 142 slidably mounted on a boss 143 secured to the casing 1 opposite to the bracket 83 by screw bolts 144. The sliding plate 142 is fitted to reciprocate in a direction parallel to the reciprocation of the carriage 85, and the reciprocation of the plate 142 is effected by means of a screw 145 having a threaded engagement with a nut 146 secured to the plate 142, which screw 145 is rotated by means of the hand wheel 147. The arm 140 is provided at the pivot 141 with a clamping handle 148 screw threaded onto the pivot 141 for the purpose of locking the arm 140 in any desired position.

The arm 140 is bifurcated at its outer end to embrace the core 104 and is provided with a pair of swivel plates 149 mounted to rotate on the said arm 140 about the pivots 150, and carrying knives 151 clamped in upright studs 152 by set screws 153. These knives are fitted to swing in a vertical plane for about ninety degrees, *i. e.*, from the horizontal to the vertical, about pivots 154; and the knife supports 155 slidably mounted on the swivel plates 149 are provided with nuts 156 having screw threaded engagement with screws 157 arranged to be operated by hand wheels 158 for advancing the knives toward one another or withdrawing them from one another. Coil springs 159 may be placed between the knife supports 155 and the end of the swivel plates 149 for yieldingly holding the knives 151 at the limit of their projection. The knife supports may further be provided with swinging keepers 160 screw threaded therein at 161, which may be swung over the knives 151, as shown in dotted lines, Fig. 8, for the purpose of preventing the knives from moving from a horizontal position in case the direction of rotation of the core 104 should be reversed.

The machine also includes a pair of bead placing rings 162 fitted to engage the side faces of the tongue or rib 163 of the core 104 and also provided with shoulders 164 for engaging the inner edge of the core tongue 163 for holding the bead placing rings concentric with respect to the core 104. The bead placing rings extend far enough up on the sides of the core so as to provide seats for accurately locating the bead cores 165 of the tire, as will be hereinafter described.

Referring to the form shown in Figs. 14 and 15 all the parts are similar to those already described except that the electric motors 138, train of gears 135, brackets 136, and ball bearings 137 therein, shafts 134 and universal joints 133 are omitted. In this form, the heads 129 of the bracket arms 127 are bifurcated and the disk rolls 132 are centrally mounted therein on similar ball bearings 131.

In operation, referring to the preferred form having the power driven forming rolls, the material of which the tire is to be composed, commonly called friction fabric or duck, is placed upon the stock roll 66 with the customary interposed cloth; the said fabric being placed on the roll 66 in the al-

ready cut bias lengths of suitable size, according to the tire that is to be built, which are customarily supplied in tire manufacture; but it is not necessary to place these strips of friction fabric in any particular order as to their cut. The advance edge of the friction fabric is passed under the guide roll 71, over the friction roll 68 and under either of the guide rolls 69 and 70, and pressed firmly upon the periphery of the core 104. At the same time, the advance edge of the interposed cloth is wrapped about the take-up roll 79 which is permitted to frictionally engage the fabric 67 on the roll 66. The weight 74 is suitably adjusted on the rod 75 to cause the desired resistance to rotation of the roll 68. The hand wheel 60 may be rotated so as to depress the frame 62 and its appurtenances until they are the desired distance away from the periphery of the core 104. The belt 27 on the change speed cones 25, 26, may be moved to the desired position so as to give the proper surface speed to the periphery of the core; either clutch 36 or 37 may be thrown in by the lever 38 so as to provide the desired rotation to the driven shaft 15; after which the jaw clutch 20 may be thrown into driving engagement for rotating the shaft 8 at low speed. As the shaft 8 is rotated, it will, in turn, rotate the core 104 drawing the friction fabric off of the stock roll 66, and stretching the latter tightly about the periphery of the core 104. It will be seen that in preparing for this operation, the resistance on the roll 68 may be varied so as to get exactly the desired amount of stretching in the friction fabric on the periphery of the core; and that this stretch or tension will be exactly uniform throughout the circumference of the core, and may be much greater than that possibly attained by the strongest operative. After one layer of fabric has been thus stretched completely about the periphery of the core, it may be formed down about the sides of the core as follows: With the set screws 118 locking the connecting rods 110, the hand wheel 117 may be turned so that the arms 97 are spread away from the core 104 a sufficient distance to permit the arms to be advanced toward the core radially with respect thereto by means of the hand wheel 88 without engaging the periphery of the core. The hand wheel 88 may then be rotated, advancing the arms 97 to the desired position, after which the hand wheel 117 may be rotated so as to permit the arms 97 to move toward one another until the disk forming rolls 132 engage the friction fabric on each side of the core at about the point where the fabric ceases to show its stretch due to the previous action of drawing it on the core. The clutch 94 may now be thrown into operative position to drive the screw 86, and the friction clutch 19 may be thrown into operative position to drive the shaft 8 and hence the core 104 at high speed; at the same time the electric motors 138 may be started at a speed sufficient to rotate the disk rollers 132 at a peripheral speed greater than the peripheral speed of that part of the core which they engage. The set screws 118 will be loosened so as to permit the arms 97 to act under the influence of the weights 103.

As the core is rotated, the disk forming rolls will advance radially across the side thereof due to the action of the power driven screw 86, thus forming the fabric tightly about the sides of the core. The knock-off 95 will disengage the clutch 94 before the disk forming rolls 132 have gone completely down to the tongue of the core and the rolls may be fed the slight remaining distance by the hand wheel 88. After the first sheet of fabric has been thus formed completely about the core by the stretching and about the sides of the core by the disk forming rolls, a second sheet of fabric may be drawn onto the core in a manner precisely similar to that already described. If the second strip of fabric was placed on the stock roll 66 with its threads at right angles to the first strip of fabric, it will be stretched upon the core by rotating the latter in the same manner and in the same direction as previously described, using the low speed. If, however, the second strip happens to have been placed on the stock roll with its threads lying in the same direction as the threads of the first strip, it will be stretched upon the core by rotating the latter in the reverse direction, the reversal of rotation of the core being obtained by engaging the one of the two clutches 36, 37, which was not engaged in the former operation. After this second strip has been thus stretched on the periphery of the core superposed on the first strip of fabric, it may be formed down about the sides of the core by the disk forming rolls 132 as previously described. This operation may be repeated, care being taken to rotate the core in such a direction as to cause alternate layers of fabric to lie with their threads at right angles to adjacent layers, until the tire has been built up to the stage at which the bead cores should be placed in position. The bead placing rings 162 are now placed one on each side of the tongue of the core, as clearly shown in Fig. 11, it being customary to have one of the bead rings hanging on the shaft 8 between the casing 1 and the spider 105 in order that they may be ready for immediate use, or the bead placing rings may be split into semicircular form so as to be readily applied to the inner side of the core. The bead placing rings may be clamped temporarily in position on the core in any desired manner, and the previously formed bead cores 165 seated on the rings

and pressed in position on the fabric already stretched on the core, the bead placing rings absolutely insuring the accurate location of the bead core. It is also convenient to have one of the previously formed bead cores hanging on the shaft 8 between the casing 1 and the spider 105, or the bead placing ring and one bead core may be hung on the casing 1 in any desired position so long as they surround the shaft 8. After the bead cores have thus been placed in position, the bead placing rings may be removed from the core and another strip or layer of friction fabric stretched thereon and formed down about the sides of the core, as previously described. The roller 96 may now be set so as to engage the knock-off 95 as soon as the forming rolls 132 reach a point where they just touch the bead cores 165, so as to throw out the clutch 94 and stop the radial movement of the forming rolls, 132, with respect to the core. The point at which the roller 96 is set to effect the above mentioned result will vary according to the size of tire being operated upon. At this point, the operator may advantageously lock the set screws 118 on the connecting rods 110 and slowly feed the rolls 132 out across the top of the bead cores 165 to the outer edge thereof, thus causing the fabric to conform to the shape of the bead on top; the locking of the connecting rods 110 preventing the sudden engagement of the rolls 132 with the bead cores 165 from throwing the arms 97 violently apart; which action, if permitted, might cause damage to the tire.

When the disk rolls have been fed outwardly until they engage the outer edge of the bead cores, the operator siezes the handles 139 and rapidly swings the slides 122 arcuately toward the positions indicated in dotted lines, Fig. 3, so that the disk rolls may have a bearing almost at right angles to the lower face of the bead core. The set screws 118 are instantly loosened and the disk rolls fed ahead the short radial distance required to form the fabric down along the bottoms of the bead cores, by means of the hand wheel 88 connected to the feed screw 86, the weights 103 continuing to draw the rolls 132 laterally toward the tongue of the core. The requisite number of layers of fabric to complete the tire body or carcass are stretched and formed about the already placed layers and bead cores in a precisely similar manner; after which the swinging arm 140 carrying the knives 151 is swung around into the position shown in full lines, Fig. 8, and the knives fed up so as to engage the fabric at the lower point of the beads of the tire, by means of the hand wheels 158. The core 104 is then rotated by throwing in the low speed clutch 21, care being taken to rotate it in a direction appropriate to the cutting edges of the knives 151, and the said knives very rapidly trim off the superfluous edges of the fabric. If it should for any reason be desired to rotate the core in the reverse direction during the cutting operation, the cutting edges of the knives 151 can be reversed by loosening the set screws 153 and turning the knives 151 upside down; after which the keeper 160 may be swung over the knives, as shown in dotted lines, Fig. 8, to prevent the knives from rising from a horizontal position while the core is being rotated. During the cutting operation, the coil springs 159 will permit the knives to yield if they meet any obstruction, and will also have the effect of holding the knives in firm engagement with the layers of fabric to be cut or trimmed off. While the arm 140 is being swung into operative position, shown in full lines, Fig. 8, the knives can be in the vertical position, shown in full lines, Fig. 9, so that they cannot, by any chance, hit the fabric on the core above the beads.

In the above description of the mode of operation it has been stated that one fabric layer may be stretched on and then formed down around the sides of the core; this operation being repeated until the desired number of layers or plies are in position. However, it is a fact that it is perfectly feasible to stretch a plurality of layers or plies of fabric on the periphery of the core, one after the other; and then form the group thus placed down about the sides of the core at one operation. This naturally tends to save some time. It will further be noted that by means of the arcuate movement of the slides 122 on the curved arms 97, and the provision of the set screws 125 which serve to lock the said plates on the said arms, the angle at which the disk rolls 132 engage the fabric on the core for forming it down about the sides thereof, may be varied to a great extent. It is desirable to have this angle almost a right angle in order to get very firm pressure for thoroughly bonding the layers of fabric. This arcuate movement also permits the fabric plies to be perfectly formed about the bead cores, without the necessity of providing any other kind or character of forming rolls, or any other apparatus.

By using weights to draw the arms 97 continuously toward the core 104, and by placing the points of attachment to the arms 97 and the pulleys 102 at the places indicated, the action of the weights will be the same throughout the movement of the arms 97 toward the core 104. This arrangement is like fluid pressure and is far superior to the use of a spring, because the action of the latter becomes less and less as the arms advance toward one another.

The trimming of the fabric by the knives 151 has been described as a final operation of the machine, but it will be readily under-

stood that this trimming can be resorted to at any time in the construction of the tire if desired.

The method of operation when using the modified form shown in Figs. 14 and 15 is the same as that hereinabove described, except that the disk rolls 132 are not independently driven but are rotated by frictional engagement with the material on the rotating core 104.

After a tire has been built up by this machine as described, the core 104 carrying the tire, may be removed from the apparatus, either with or without the spider 105; after which the rubber tread may be placed thereon and the tire vulcanized or cured in any desired manner.

The forming rolls may be relatively small or large, but we have found that a diameter greater than the section of the core is desirable; and that it is particularly advantageous to rotate said rolls rapidly when the fabric, for any reason, fails to readily form about the sides of the core.

We have found that the mechanism described for stretching the fabric on the periphery of the core is so efficacious that the necessity for having a roll for forming the fabric on this part of the core is obviated.

It will also be understood that the extent of the arcuate movement of the curved slide 122 in either direction may be fixed to suit particular conditions by varying the length of the slots 123 or the location of the pins 124 or 124*.

It will be understood that changes might be resorted to in the form, construction and arrangement of the several parts without departing from the spirit and scope of the invention; hence we do not wish to limit ourselves strictly to the structure herein set forth, but

What we claim is:—

1. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, means for rotating the core, and forming rolls power rotated by mechanism independent of the core rotating means for forming the material on the core.

2. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, means for rotating the core, and forming rolls power rotated by mechanism independent of the core rotating means for forming the material on the core, said rolls being greater in diameter than the core section.

3. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism adapted to pass radially across the core for forming the material thereon, automatic means for holding said mechanism laterally against the core, and means for varying said lateral pressure at will.

4. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism adapted to pass radially across the core for forming the material thereon, automatic means for holding said mechanism laterally against the core, means for varying said lateral pressure at will, and means for throwing said last-mentioned means into and out of operative position.

5. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, a pair of devices adapted to pass radially across the core for forming the material thereon, automatic means for holding said devices laterally against the core, and means for varying the lateral pressure of either device at will.

6. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, a pair of devices adapted to pass radially across the core for forming the material thereon, automatic means for holding said devices laterally against the core, means for varying the lateral pressure of either device at will, and means for throwing said last-mentioned means into and out of operative position with respect to either device.

7. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, automatic means for moving said mechanism radially across the core, and means for automatically stopping said radial movement at a predetermined point.

8. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, automatic means for moving said mechanism radially across the core, automatic means for pressing the said mechanism laterally against the core, and means for automatically stopping said radial movement at a predetermined point.

9. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, automatic means for moving said mechanism radially across the sides of the core, means for automatically stopping said radial movement at a predetermined point, and means for continuing said radial movement.

10. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the mate-

rial on the core, automatic means for moving said mechanism radially across the sides of the core, means for automatically stopping said radial movement at a predetermined point, and manually operated means for continuing said radial movement.

11. A machine of the character described comprising a rotary core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, automatic means for moving said mechanism radially across the core, and means for changing the rotary speed of the core and the radial speed of the forming mechanism.

12. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement.

13. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement at any point in the course of the radial movement.

14. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining the same angle of engagement throughout the forming operation.

15. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for varying the angular position of the forming elements, whereby they may engage differently lying portions of the material at substantially the same working angle.

16. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining a substantially right angular engagement throughout the forming operation.

17. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon and a single mechanism adapted to form the tire fabric on the core and over the bead cores.

18. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, and means for maintaining substantially the same angle of engagement throughout the radial movement.

19. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core, both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, and means for automatically stopping said radial movement at the top of the bead cores.

20. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, means for automatically stopping said radial movement at the top of the bead cores, and means for continuing said radial movement to the base of the bead cores.

21. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism comprising a device adapted to move ra-

dially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, means for automatically stopping said radial movement at the top of the bead cores, and manually operated means for continuing said radial movement to the base of the bead cores.

22. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming elements adapted to move arcuately in planes at an angle to the plane of the core for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

23. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming elements arranged to engage the material on the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the forming elements with the material throughout the forming operation.

24. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming elements fitted to move arcuately in planes at an angle to the plane of the core with the operating face of the forming elements as the center of the circle of the arc for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

25. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming elements arranged to engage the material on the core, said supports being fitted to move arcuately with the operating face of the forming elements as the center of the circle of the arc for maintaining a suitable angle of engagement of the forming elements with the material throughout the forming operation.

26. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core including a device adapted to move radially with respect to the core, forming elements carried by the said device and arranged to move arcuately for maintaining a suitable angle of engagement throughout the forming operation, and means for pressing said forming elements laterally against the material on the core.

27. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming elements arranged to engage the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the forming elements with the material on the core, and means for pressing the forming elements laterally against the material on the core.

28. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried thereby and adapted to engage the material on the core, said forming elements being arranged to move arcuately at any stage of the forming operation for maintaining a suitable angle of engagement with the material on the core.

29. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism being laterally pressed toward the core and adapted to move arcuately in a plane at an angle to the plane of the core for varying its relation with respect to the core.

30. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism comprising a device adapted to move radially with respect to the core and forming elements laterally pressed toward the core, said forming elements being fitted to move arcuately for varying their relation to the core.

31. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming elements arranged to move radially with respect to the core and arcuately in planes at an angle to the plane of the core.

32. A machine of the character described

comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including forming elements fitted to move radially with respect to the core and arcuately in planes at an angle to the plane of the core and pressed laterally toward the core with equal pressure at all times.

33. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including forming elements fitted to move radially with respect to the core and arcuately in a plane substantially at right angles to the plane of the core, said forming elements being laterally pressed toward the core, and means for resisting said lateral pressure.

34. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and power rotated rolls for forming the material on the sides of the core.

35. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and rolls of greater diameter than the core section for forming the material on the sides of the core.

36. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and power rotated rolls of greater diameter than the core section for forming the material on the sides of the core.

37. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism adapted to pass radially across the core for forming the material on the sides thereof, automatic means for holding said mechanism laterally against the core, and means for varying said lateral pressure at will.

38. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism adapted to pass radially across the core for forming the material on the sides thereof, automatic means for holding said mechanism laterally against the core, means for varying said lateral pressure at will, and means for throwing said last-mentioned means into and out of operative position.

39. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, a pair of devices adapted to pass radially across the core for forming the material on the sides thereof, automatic means for holding said devices laterally against the core, and means for varying the lateral pressure of either device at will.

40. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, a pair of devices adapted to pass radially across the core for forming the material on the sides thereof, automatic means for holding said devices laterally against the core, means for varying the lateral pressure of either device at will, and means for throwing said last-mentioned means into and out of operative position with respect to either device.

41. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, automatic means for moving said mechanism radially across the core, and means for automatically stopping said radial movement at a predetermined point.

42. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, automatic means for moving said mechanism radially across the core, automatic means for pressing the said mechanism laterally against the core, and means for automatically stopping said radial movement at a predetermined point.

43. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, automatic means for moving said mechanism radially across the sides of the core, means for automatically stopping said radial movement at a predetermined point, and means for continuing said radial movement.

44. A machine of the character described comprising a rotary core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, automatic means for moving said mechanism radially across the core, and means for changing the rotary speed of the core and the radial speed of the forming mechanism.

45. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device

adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement.

46. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement at any point in the course of the radial movement.

47. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining the same angle of engagement throughout the forming operation.

48. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for varying the angular position of the forming elements, whereby they may engage differently lying portions of the material at substantially the same working angle.

49. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining a substantially right angular engagement throughout the forming operation.

50. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, means for placing bead cores thereon, and a single mechanism adapted to form the tire fabric on the sides of the core and over the bead cores.

51. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, means for placing bead cores thereon, and mechanism for forming the fabric on the sides of the core both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, and means for maintaining substantially the same angle of engagement throughout the radial movement.

52. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, means for placing bead cores thereon, and mechanism for forming the fabric on the sides of the core both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, and means for automatically stopping said radial movement at the top of the bead cores.

53. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, means for placing bead cores thereon, and mechanism for forming the fabric on the sides of the core both under and over the bead cores, said mechanism comprising a device adapted to move radially with respect to the core, forming elements carried by said device and arranged to engage the material at an angle thereto, means for automatically stopping said radial movement at the top of the bead cores, and means for continuing said radial movement to the base of the bead cores.

54. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including forming elements adapted to move arcuately in planes at an angle to the plane of the core for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

55. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming elements arranged to engage the material on

the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the forming elements with the material throughout the forming operation.

56. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including forming elements fitted to move arcuately in planes at an angle to the plane of the core with the operating face of the forming elements as the center of the circle of the arc for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

57. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming elements arranged to engage the material on the core, said supports being fitted to move arcuately with the operating face of the forming elements as the center of the circle of the arc for maintaining a suitable angle of engagement of the forming elements with the material throughout the forming operation.

58. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core including a device adapted to move radially with respect to the core, forming elements carried by the said device and arranged to onto arcuately for maintaining a suitable adapted engagement throughout the formforming the and means for pressing said automatic means laterally against the manism laterally against for varying said later

the character described

38. A machine of on which a tire may be comprising a core upetching tire material built, means for stretof the core, mechanism the periphery of the rial on the sides of the ed to pass radially ac including a device ing the material on tally with respect to the matic means for hol pivoted thereon, suplaterally against the carrying forming elesaid lateral pressure gage the core, said supthrowing said last-me move arcuately for out of operative posible angle of engage-

39. A machine of elements with the macomprising a core upnd means for pressing built, means for stretes laterally against the the periphery of the

the character described

comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the ore, and mechanism for forming the material on the sides of the core, said mechanism including a device adapted to move radially with respect to the core, forming elements carried thereby and adapted to engage the material on the core, said forming elements being arranged to move arcuately at any stage of the forming operation for maintaining a suitable angle of engagement with the material on the core.

61. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism being laterally pressed toward the core and adapted to move arcuately in planes at an angle to the plane of the core for varying its relation with respect to the core.

62. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism comprising a device adapted to move radially with respect to the core and forming elements laterally pressed toward the core, said forming elements being fitted to move arcuately for varying their relation to the core.

63. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including forming elements arranged to move radially with respect to the core and arcuately in planes at an angle to the plane of the core.

64. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, and mechanism for forming the material on the sides of the core, said mechanism including forming elements fitted to move radially and arcuately with respect to the core and pressed laterally toward the core with equal pressure at all times.

65. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, said mechanism including forming elements adapted to move arcuately in planes at an angle to the plane of the core, said elements being laterally pressed toward the core, and means for resisting said lateral pressure.

66. A machine of the character described

comprising a core upon which a tire may be built, means for stretching tire material onto the periphery of the core, mechanism for forming the material on the sides of the core, said mechanism including forming elements fitted to move radially with respect to the core and arcuately in planes at an angle to the plane of the core, said forming elements being laterally pressed toward the core, and means for resisting said lateral pressure.

67. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said rolls laterally against the core, and means for varying said lateral pressure at will.

68. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said rolls laterally against the core, means for varying said lateral pressure at will, and means for throwing said last-mentioned means into and out of operative position.

69. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, a pair of rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said rolls laterally against the core, and means for varying the lateral pressure of either roll at will.

70. A machine of the character described comprising a core upon upon which a tire may be built, means for supplying tire material thereto, a pair of rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said rolls laterally against the core, means for varying the lateral pressure of either roll at will, and means for throwing said last-mentioned means into and out of operative position with respect to either roll.

71. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, rolls for forming the material on the core, automatic means for moving said rolls radially across the core, and means for automatically stopping said radial movement at a predetermined point.

72. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, rolls for forming the material on the core, automatic means for moving said rolls radially across the core, automatic means for pressing the said rolls laterally against the core, and means for automatically stopping said radial movement at a predetermined point.

73. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, rolls for forming the material on the core, automatic means for moving said rolls radially across the sides of the core, means for automatically stopping said radial movement at a predetermined point, and means for continuing said radial movement.

74. A machine of the character described comprising a rotary core upon which a tire may be built, means for supplying tire material thereto, rolls for forming the material on the core, automatic means for moving said rolls radially across the core, and means for changing the rotary speed of the core and the radial speed of the forming rolls.

75. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement.

76. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement at any point in the course of the radial movement.

77. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining the same angle of engagement throughout the forming operation.

78. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for varying the angu-

lar position of the forming rolls, whereby they may engage differently lying portions of the material at substantially the same working angle.

79. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining a substantially right angular engagement throughout the forming operation.

80. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a roll adapted to form the tire fabric on the core and over the bead cores.

81. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material at an angle thereto, and means for maintaining substantially the same angle of engagement throughout the radial movement.

82. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core, both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material at an angle thereto, and means for automatically stopping said radial movement at the top of the bead cores.

83. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried by said device and arranged to engage the material at an angle thereto, means for automatically stopping said radial movement at the top of the bead cores, and means for continuing said radial movement to the base of the bead cores.

84. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming rolls adapted to move arcuately in planes at an angle to the plane of the core for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

85. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming rolls arranged to engage the material on the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the forming rolls with the material throughout the forming operation.

86. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming rolls fitted to move arcuately with the operating face of the forming rolls as the center of the circle of the arc for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

87. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming rolls arranged to engage the material on the core, said supports being fitted to move arcuately with the operating face of the forming rolls as the center of the circle of the arc for maintaining a suitable angle of engagement of the forming rolls with the material throughout the forming operation.

88. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core including a device adapted to move radially with respect to the core, forming rolls carried by the said device and arranged to move arcuately for maintaining a suitable angle of engagement throughout the forming operation, and means for pressing said forming rolls laterally against the material on the core.

89. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including a de-

vice adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying forming rolls arranged to engage the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the forming rolls with the material on the core, and means for pressing the forming rolls laterally against the material on the core.

90. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, forming rolls carried thereby, and adapted to engage the material on the core, said forming rolls being arranged to move arcuately at any stage of the forming operation for maintaining a suitable angle of engagement with the material on the core.

91. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and rolls for forming the material on the core, said rolls being laterally pressed toward the core and adapted to move arcuately in planes at an angle to the plane of the core for varying their relation with respect to the core.

92. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core and forming rolls laterally pressed toward the core, said forming rolls being fitted to move arcuately for varying their relation to the core.

93. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including forming rolls arranged to move radially with respect to the core and arcuately in planes at an angle to the plane of the core.

94. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for formi..g the material on the core, said mechanism including forming rolls fitted to move radially and arcuately with respect to the core and pressed laterally toward the core with equal pressure at all times.

95. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including forming rolls adapted to move arcuately in planes at an angle to the plane of the core, said rolls being laterally pressed toward the core, and means for resisting said lateral pressure.

96. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including forming rolls fitted to move radially with respect to the core and arcuately in planes at an angle to the plane of the core, said forming rolls being laterally pressed toward the core, and means for resisting said lateral pressure.

97. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls adapted to pass radially across the core for forming the material thereon, and means for holding said power driven rolls laterally against the core with equal pressure throughout their movement.

98. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls adapted to pass radially across the core for forming the material thereon, and a weight so arranged as to hold said power driven rolls laterally against the core with equal pressure throughout its movement.

99. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven swinging rolls adapted to pass radially across the core for forming the material thereon, and means for holding said power driven rolls laterally against the core with equal pressure throughout its movement, said means comprising a weight, a fixed pulley and a cord secured to the weight and forming rolls and passing over the said pulley, both the pulley and the point of attachment of the cord to the forming rolls being substantially equidistant from the fulcrum point of the forming rolls.

100. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said power driven rolls laterally against the core, and means for varying said lateral pressure at will.

101. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls adapted to pass

radially across the core for forming the material thereon, automatic means for holding said power driven rolls laterally against the core, means for varying said lateral pressure at will, and means for throwing said last-mentioned means into and out of operative position.

102. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, a pair of power driven rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said power driven rolls laterally against the core, and means for varying the lateral pressure of either roll at will.

103. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, a pair of power driven rolls adapted to pass radially across the core for forming the material thereon, automatic means for holding said power driven rolls laterally against the core, means for varying the lateral pressure on either roll at will, and means for throwing said last-mentioned means into and out of operative position with respect to either power driven roll.

104. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, and automatic means for moving said power driven rolls radially across the core.

105. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, automatic means for moving said power driven rolls radially across the core, and means for automatically stopping said radial movement at a predetermined point.

106. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, automatic means for moving said power driven rolls radially across the core, and automatic means for pressing the said power driven rolls laterally against the core.

107. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, automatic means for moving said power driven rolls radially across the core, automatic means for pressing the said power driven rolls laterally against the core, and means for automatically stopping said radial movement at a predetermined point.

108. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, automatic means for moving said power driven rolls radially across the sides of the core, means for automatically stopping said radial movement at a predetermined point, and means for continuing said radial movement.

109. A machine of the character described comprising a rotary core upon which a tire may be built, means for supplying tire material thereto, power driven rolls for forming the material on the core, automatic means for moving said power driven rolls radially across the core, and means for changing the rotary speed of the core and the radial speed of the rolls.

110. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement.

111. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the core at an angle to the plane thereof, and means for varying the said angle of engagement at any point in the course of the radial movement.

112. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining the same angle of engagement throughout the forming operation.

113. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for varying the angu-

lar position of the rolls, whereby they may engage differently lying portions of the material at substantially the same working angle.

114. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material on the core at an angle to the said material, and means for maintaining a substantially right angular engagement throughout the forming operation.

115. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a power driven roll adapted to form the tire fabric on the core both under and over the bead cores.

116. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material at an angle thereto, and means for maintaining substantially the same angle of engagement throughout the radial movement.

117. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material at an angle thereto, and means for automatically stopping said radial movement at the top of the bead cores.

118. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and mechanism for forming the fabric on the core both under and over the bead cores, said mechanism including a device adapted to move radially with respect to the core, power driven rolls carried by said device and arranged to engage the material at an angle thereto, means for automatically stopping said radial movement at the top of the bead cores, and means for continuing said radial movement to the base of the bead cores.

119. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including power driven rolls adapted to move arcuately for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

120. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying power driven rolls arranged to engage the material on the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the power driven rolls with the material throughout the forming operation.

121. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including power driven rolls fitted to move arcuately with the operating face of the power driven rolls as the center of the circle of the arc for maintaining a suitable angle of engagement with the material on the core throughout the forming operation.

122. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying power driven rolls arranged to engage the material on the core, said supports being fitted to move arcuately with the operating face of the power driven rolls as the center of the circle of the arc for maintaining a suitable angle of engagement of the power driven rolls with the material throughout the forming operation.

123. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core including a device adapted to move radially with respect to the core, power driven rolls carried by the said device and arranged to move arcuately for maintaining a suitable angle of engagement throughout the forming operation, and means for pressing said power driven rolls laterally against the material on the core.

124. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including a

device adapted to move radially with respect to the core, a pair of arms pivoted thereon, supports on said arms carrying power driven rolls arranged to engage the core, said supports being fitted to move arcuately for maintaining a suitable angle of engagement of the power driven rolls with the material on the core, and means for pressing the power driven rolls laterally against the material on the core.

125. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core, power driven forming rolls carried thereby and adapted to engage the material on the core, said power driven forming rolls being arranged to move arcuately at any stage of the forming operation for maintaining a suitable angle of engagement with the material on the core.

126. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and power driven rolls for forming the material on the core, said power driven rolls being laterally pressed toward the core and adapted to move arcuately for varying their relation with respect to the core.

127. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including a device adapted to move radially with respect to the core and power driven forming rolls laterally pressed toward the core, said power driven forming rolls being fitted to move arcuately for varying their relation to the core.

128. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, and mechanism for forming the material on the core, said mechanism including power driven forming rolls arranged to move radially and arcuately with respect to the core.

129. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto and mechanism for forming the material on the core, said mechanism including power driven forming rolls fitted to move radially and arcuately with respect to the core and pressed laterally toward the core.

130. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including power driven forming rolls laterally pressed toward the core, and means for resisting said lateral pressure.

131. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including power driven forming rolls arranged to move radially with respect to the core, the said power driven forming rolls being laterally pressed toward the core, and means for resisting said lateral pressure.

132. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including power driven forming rolls adapted to move arcuately with respect to the core, said power driven forming rolls being laterally pressed toward the core, and means for resisting said lateral pressure.

133. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, mechanism for forming the material on the core, said mechanism including power driven forming rolls fitted to move radially and arcuately with respect to the core, said power driven forming rolls being laterally pressed toward the core, and means for resisting said lateral pressure.

134. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, means for rotating said core, rotatable mechanism for forming the material on the core, and means for driving said forming mechanism at a greater surface speed than the core.

135. A machine of the character described comprising a core upon which a tire may be built, means for supplying tire material thereto, means for rotating said core, rolls for forming the material on the core, and means for driving said rolls at a greater surface speed than the core.

136. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a single mechanism adapted to move radially with respect to the core and arcuately in a plane substantially at right angles to the plane of the core for forming the tire fabric on the core both under and over the bead cores.

137. A machine of the character described comprising a core upon which a tire may be built, means for stretching tire fabric on to the periphery of the core, means for placing bead cores on said core, and a single mechanism adapted to move radially with respect to the core and arcuately in a plane substantially at right angles to the plane of the core for forming the tire fabric on the

sides of the core both under and over the bead cores.

138. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a roll adapted to move radially with respect to the core and arcuately in a plane substantially at right angles to the core for forming the tire fabric on the core both under and over the bead cores.

139. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a pair of rolls adapted to move radially with respect to the core and arcuately in a plane substantially at right angles to the plane of the core for forming the fabric on both sides of the core, both under and over the bead cores.

140. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a power driven roll adapted to move radially and arcuately with respect to the core for forming the tire fabric on the core both under and over the bead cores.

141. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a pair of power driven rolls adapted to move radially and arcuately with respect to the core for forming the tire on the core both under and over the bead cores.

142. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a device arranged to engage differently lying portions of the material at substantially the same working angle for forming the fabric on the core both under and over the bead cores.

143. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon and a pair of devices arranged to engage differently lying portions of the material at substantially the same working angle for forming the fabric on the core both under and over the bead cores.

144. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a single mechanism for forming the tire fabric on the core both under and over the bead cores, said mechanism comprising a pivoted arm mounted to move radially with respect to the core, that portion of the arm nearer the core being of curved formation, a bracket arm fitted to slide on the curved portion of said arm, and a forming element carried by the bracket arm and adapted to be moved laterally toward and away from the core by swinging the first-mentioned arm on its pivot.

145. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, and a single mechanism for forming the tire fabric on the core both under and over the bead cores, said mechanism comprising a pair of pivoted arms mounted to move radially with respect to the core, that portion of the arms nearer the core being of curved formation, bracket arms fitted to slide on the curved portions of said arms, and forming elements carried by the bracket arms and adapted to be moved laterally toward and away from the core by swinging the first-mentioned arms on their pivots.

146. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, a single mechanism for forming the tire fabric on the core both under and over the bead cores, said mechanism comprising a pair of pivoted arms mounted to move radially with respect to the core, that portion of the arms nearer the core being of curved formation, bracket arms fitted to slide on the curved portions of said arms, forming elements carried by the bracket arms and adapted to be moved laterally toward and away from the core by swinging the first-mentioned arms on their pivots, and means for positively swinging either of said arms on its pivot.

147. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, a single mechanism for forming the tire fabric on the core both under and over the bead cores, said mechanism comprising a pair of pivoted arms mounted to move radially with respect to the core, that portion of the arms nearer the core being of curved formation, bracket arms fitted to slide on the curved portions of said arms, forming elements carried by the bracket arms and adapted to be moved laterally toward and away from the core by swinging the first-mentioned arms on their pivots, and means for positively and simultaneously swinging both said arms on their pivots.

148. A machine of the character described comprising a core upon which a tire may be built, means for placing tire fabric and bead cores thereon, a single mechanism for forming the tire fabric on the core both under and over the bead cores, said mechanism comprising a pair of pivoted arms mounted to move radially with respect to the core, that portion of the arms nearer the core being of curved formation, bracket arms fitted to slide on the curved portions of said arms, forming elements carried by the

bracket arms, and adapted to be moved laterally toward and away from the core by swinging the first-mentioned arms on their pivots, and means for positively and simultaneously swinging both said arms in opposite directions on their pivots.

In testimony, that we claim the foregoing as our invention, we have signed our names in presence of two witnesses. this twenty-second day of January 1912.

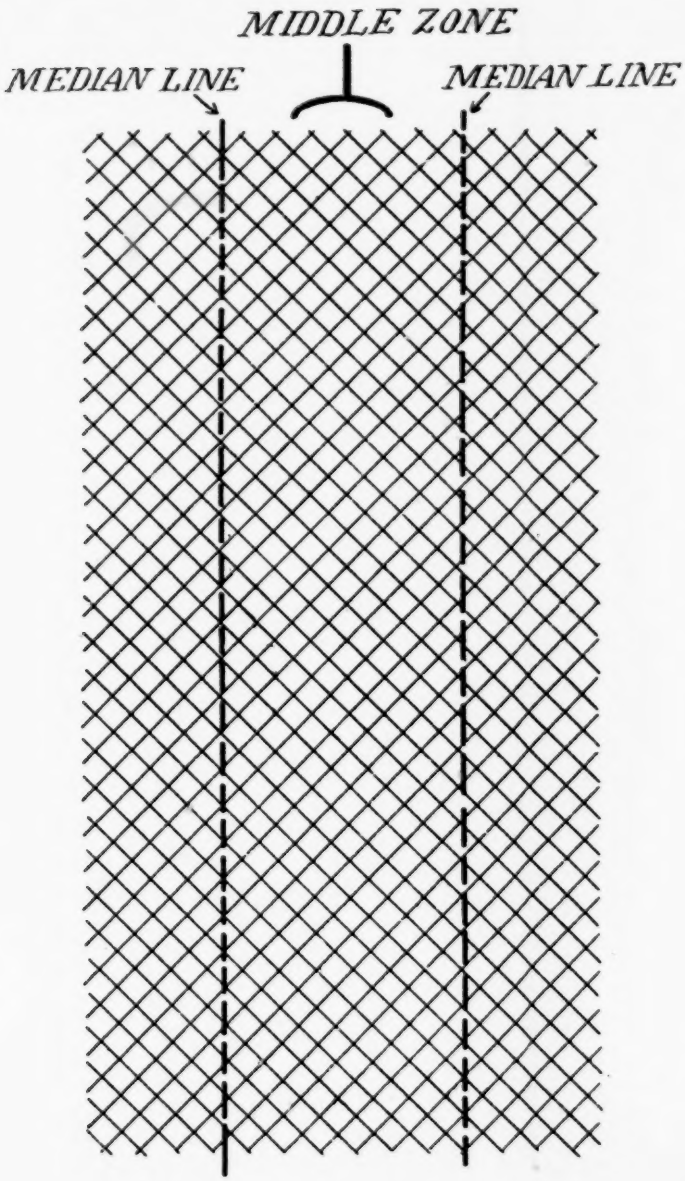
JOHN E. THROPP.
PETER D. THROPP.
ALBERT DE LASKI.

Witnesses:
F. GEORGE BARRY,
HENRY C. THIEME.

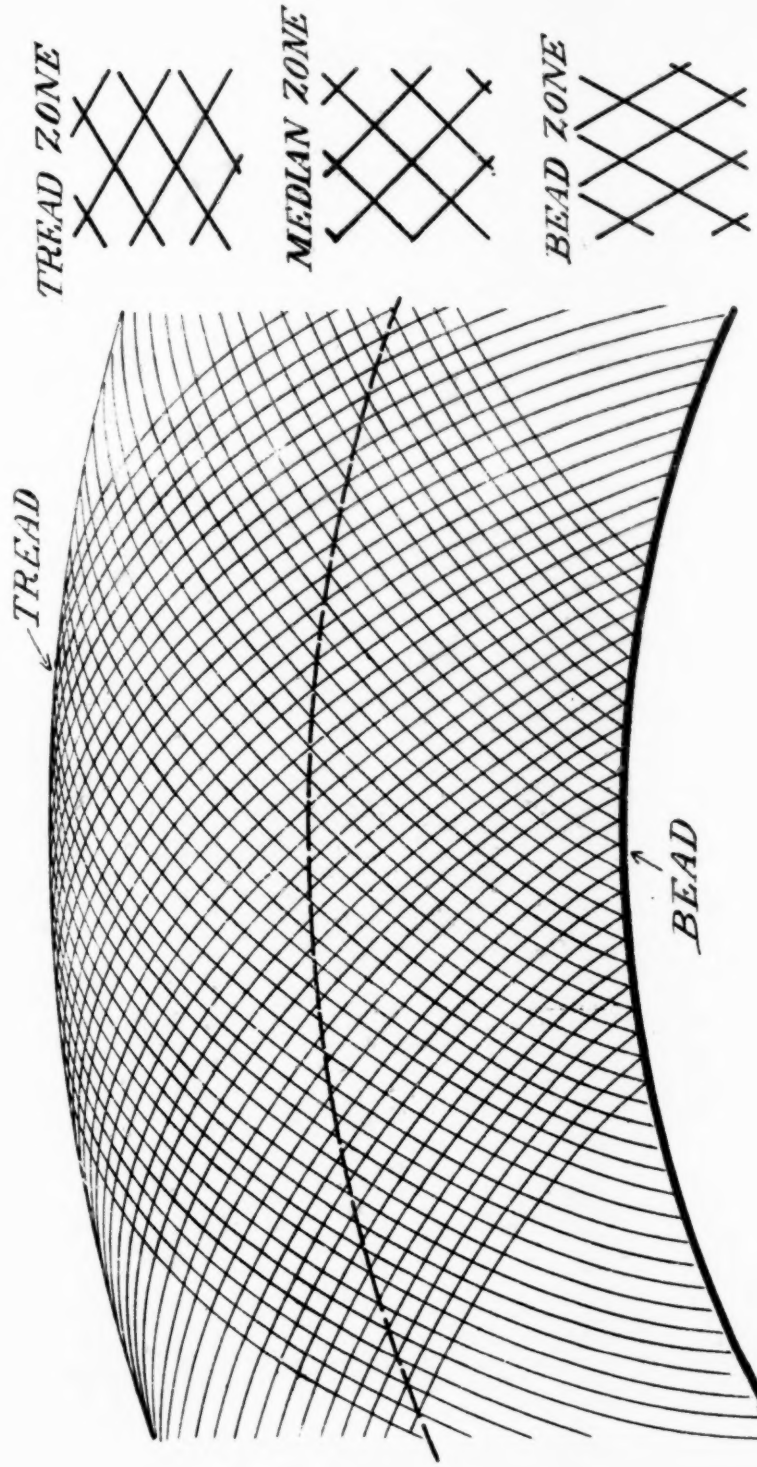
Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."

Plaintiff's Exhibit No. 4.

ORIGINAL FLAT FABRIC BEFORE SHAPING.

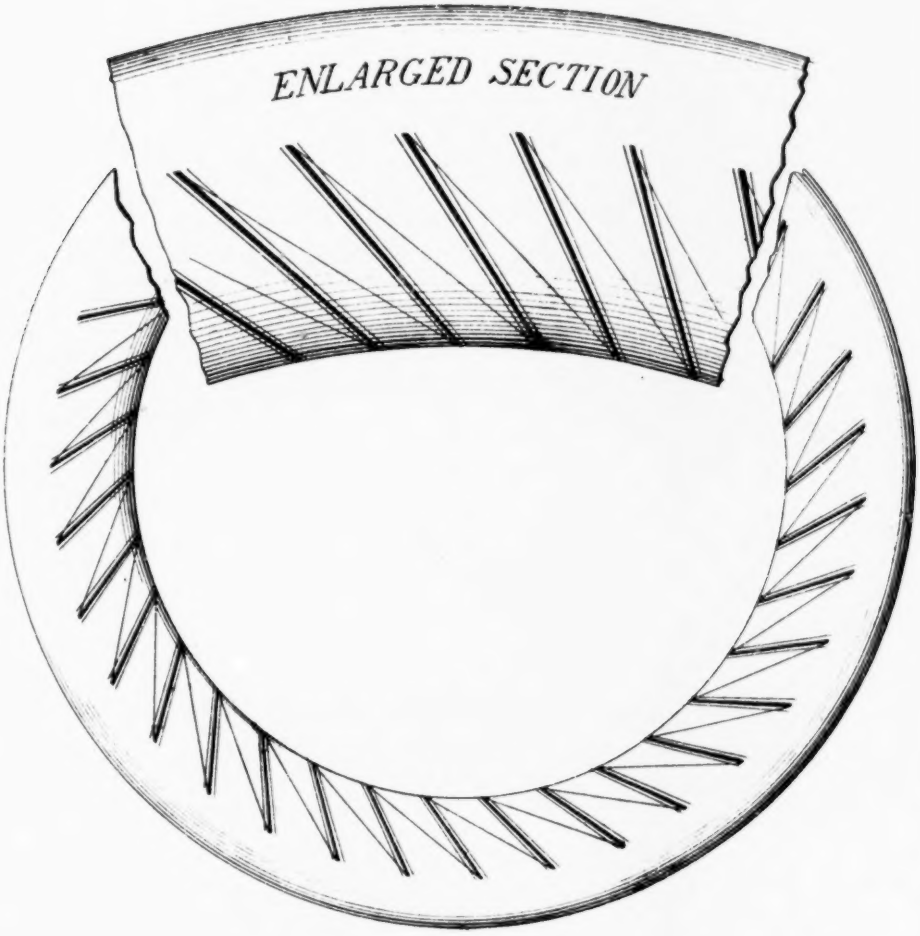


Plaintiff's Exhibit No. 5—Fabric Shaped to Core.

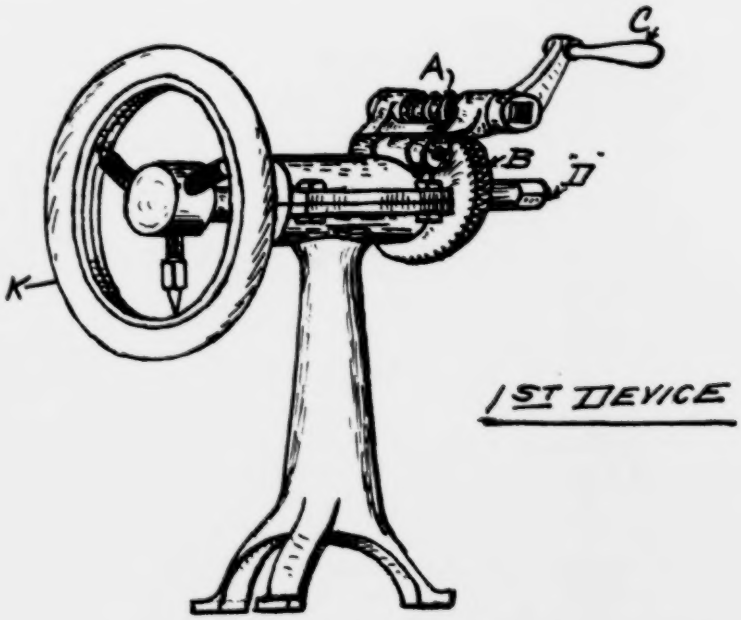


Plaintiff's Exhibit No. 7.

SAW TOOTH PATH OF HAND TOOL

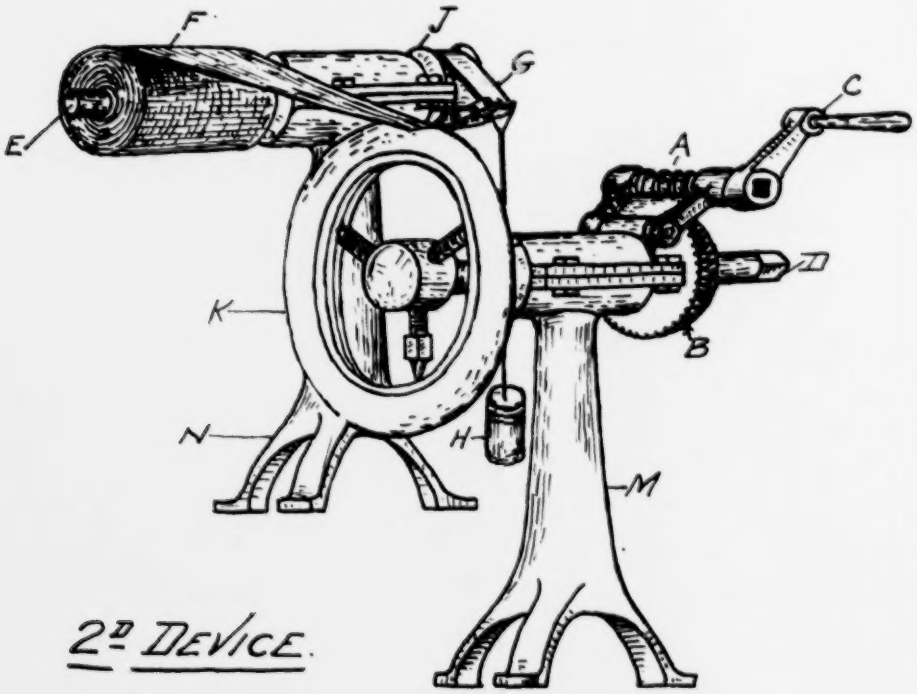


Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (1st Device.)



NOTE- WORM "A" & GEAR "B" DISENGAGE HANDLE "C" USED ON END OF SPINDLE "D" TO SPIN CORE. "K"

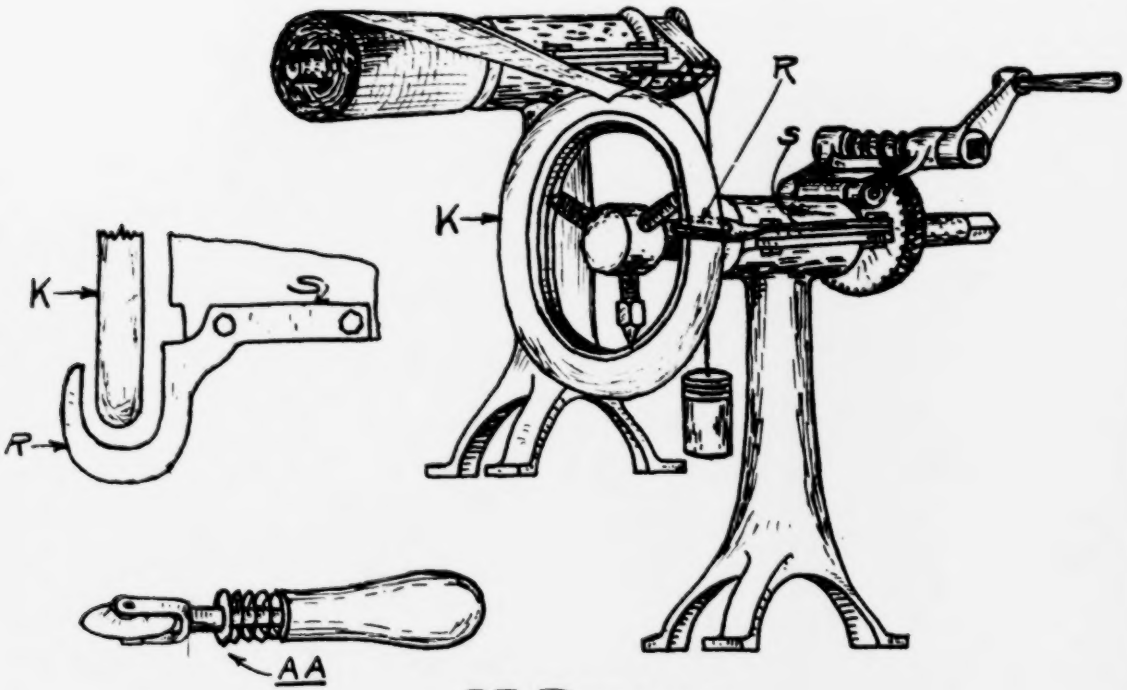
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (2nd Device.)



2D DEVICE.

NOTE= WORM "A" & GEAR "B" DISENGAGED AFTER PLY "F" IS PULLED ON CORE "K". HANDLE "C" TRANSFERRED TO SPINDLE "D" TO SPIN CORE "K". STOCK ROLL STAND "N" FITTED WITH BRAKE "J&G" WEIGHTED AS SHOWN "H" STOCK ROLL SLEEVE KEYED TO SPINDLE "E" OPERATING WITH "J&G". ROLLS OF STOCK "F" CHANGED FOR EACH PLY. OR AS OFTEN AS REQUIRED.

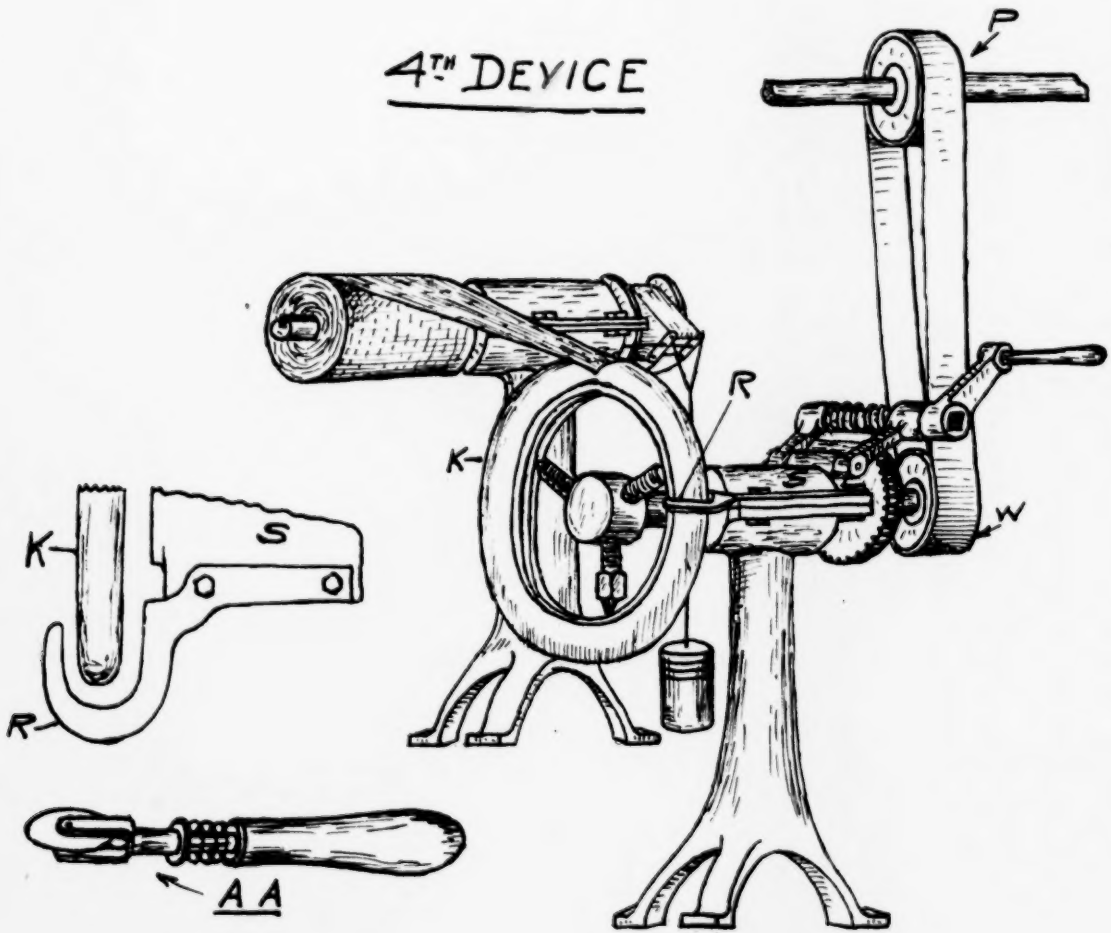
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (3rd Device.)



3D DEVICE

OPERATION OF THIS DEVICE IS THE SAME AS ON 2D DEVICE, IN ADDITION THERE IS ATTACHED A TOOL SUPPORT "R" IN BRACKET FORM SECURED BY BOLTS ON HOUSING "S" ATTACHMENT USED FOR MANIPULATING VARIOUS TOOLS BY HAND SUCH AS STITCHER "AA" ETC.

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (4th Device.)



OPERATION OF THIS DEVICE SAME AS 3D DEVICE WITH THE ADDITION OF POWER DRIVE "P & W," PULLEYS SELECTED TO SUIT R.P.M OF "K"

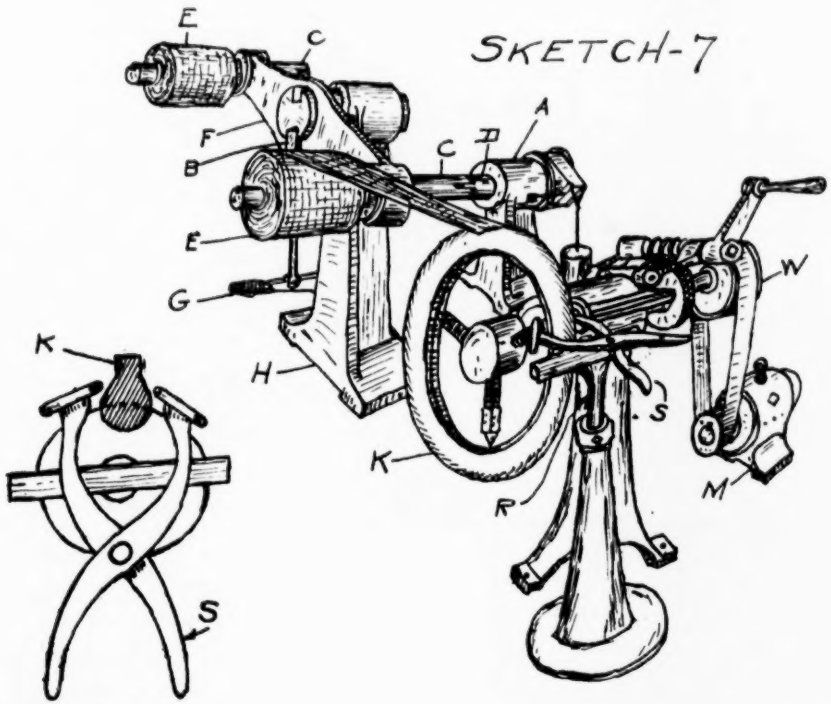
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (5th Device.)

5TH DEVICE

NOTE. OPERATION OF THIS DEVICE SAME AS 4TH DEVICE MOTOR DRIVEN INSTEAD OF OVERHEAD DRIVE.

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 7.)

A- CLUTCH & BRAKE SUPPORT.
B- SWINGING ARM LOCK.
C- SPINDLE WITH CLUTCH SLOT.
D- BRAKE & CLUTCH SHAFT.
E- FABRIC ROLLS.
F- SWINGING ARM.
G- LOCK LATCH PEDAL.
H- ARM SUPPORT.



K- CORE.
R- STITCHER SUPPORT
S- STITCHER DEVICE.

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 7*a*.)

30

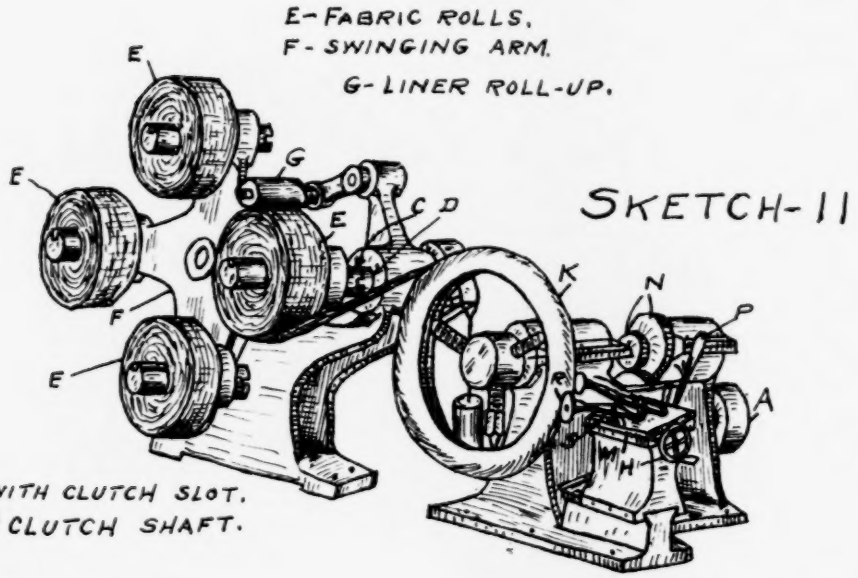
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 7b.)

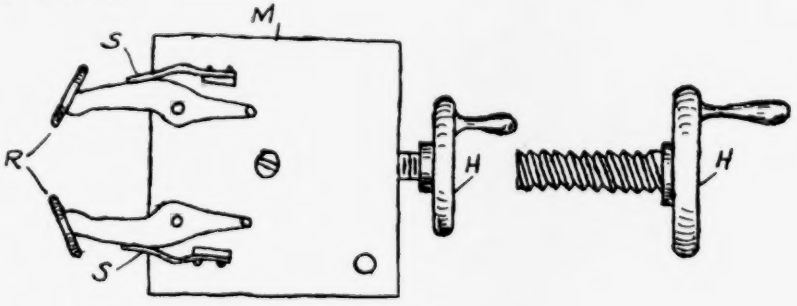
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 8.)

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 9.)

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 10.)

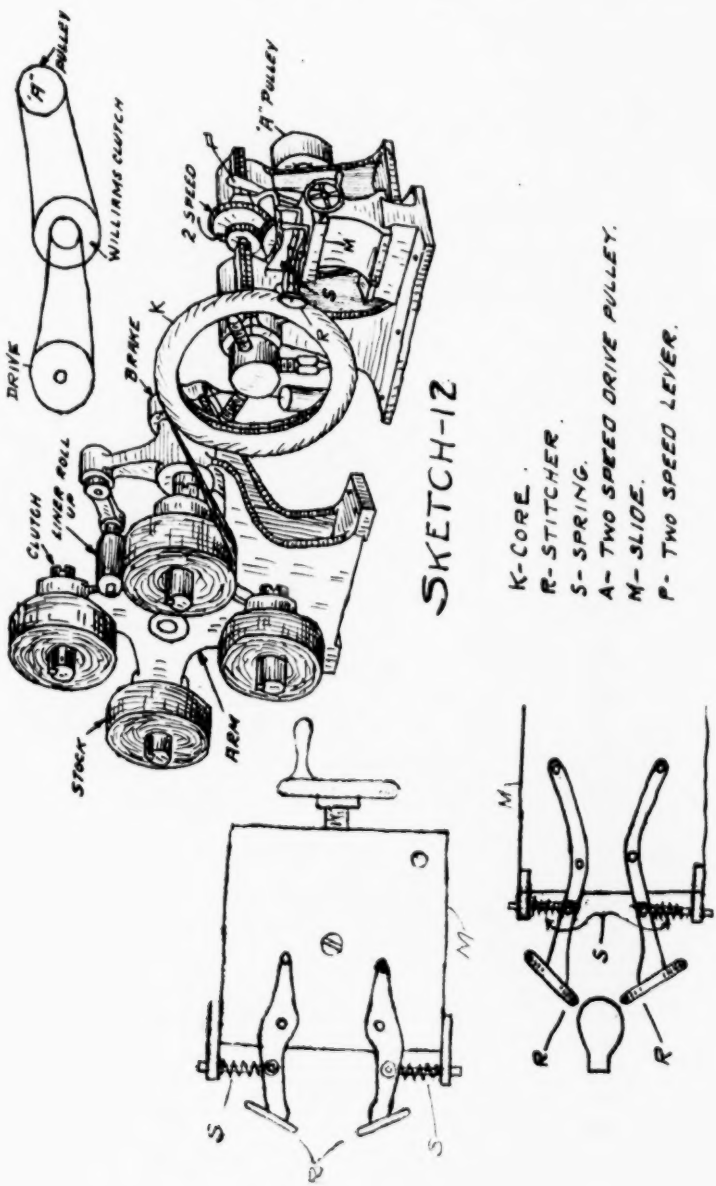
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 11.)





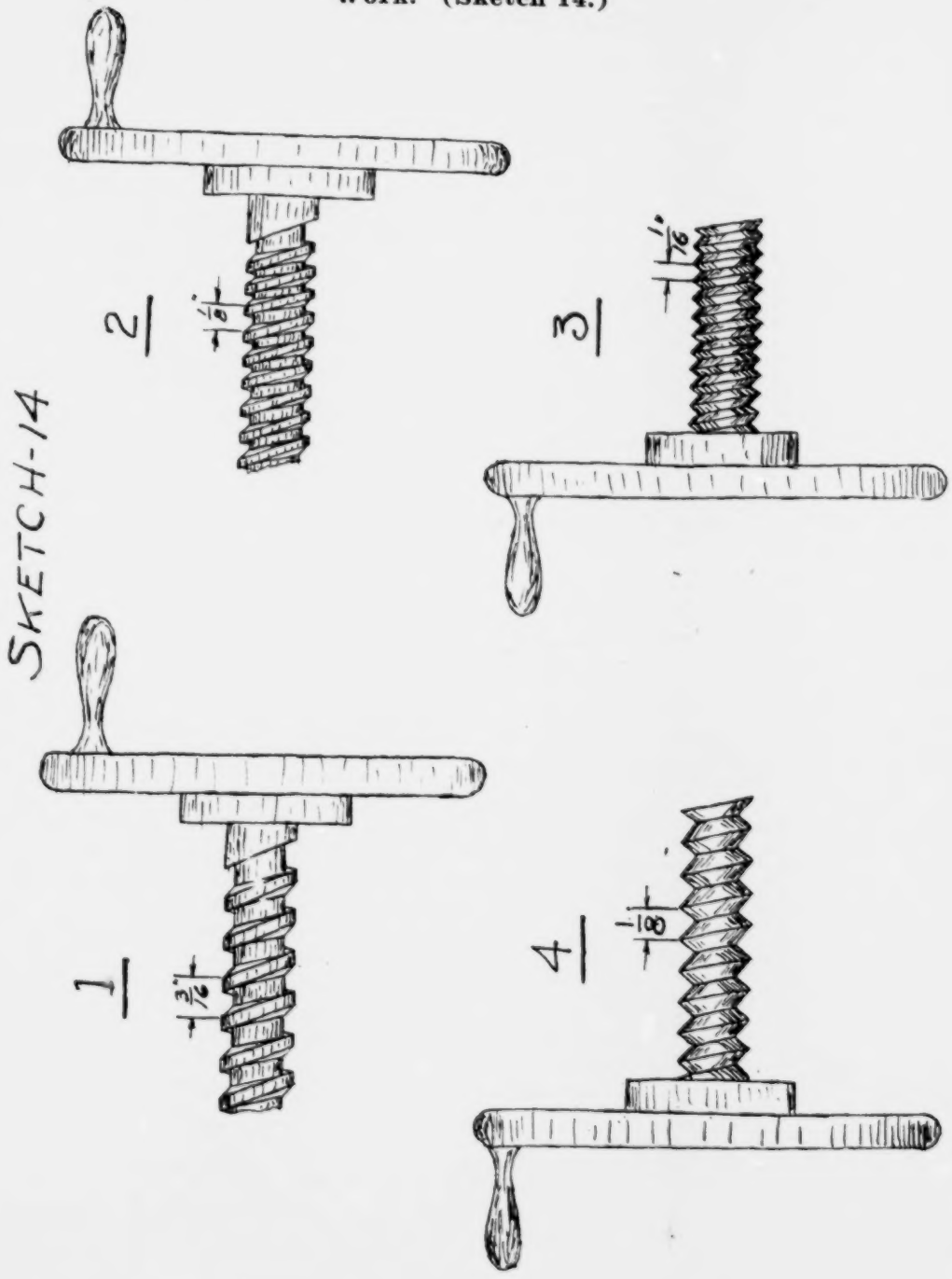
H- STITCHER SLIDE FEED.
M- STITCHER SLIDE.
R- STITCHER.
P- TWO SPEED LEVER.

Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 12.)

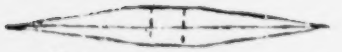


Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 13.)

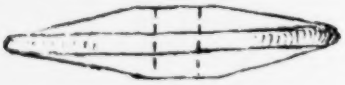
Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 14.)



Plaintiff's Exhibit No. 8—Sketches of Experimental Work. (Sketch 15.)

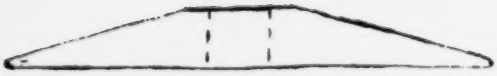


HAND STITCHER WHEEL

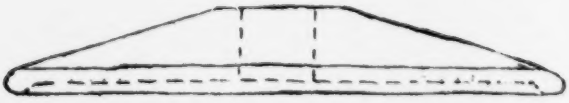


HAND STITCHER WHEEL

SKETCH-15



MACHINE STITCHER WHEEL

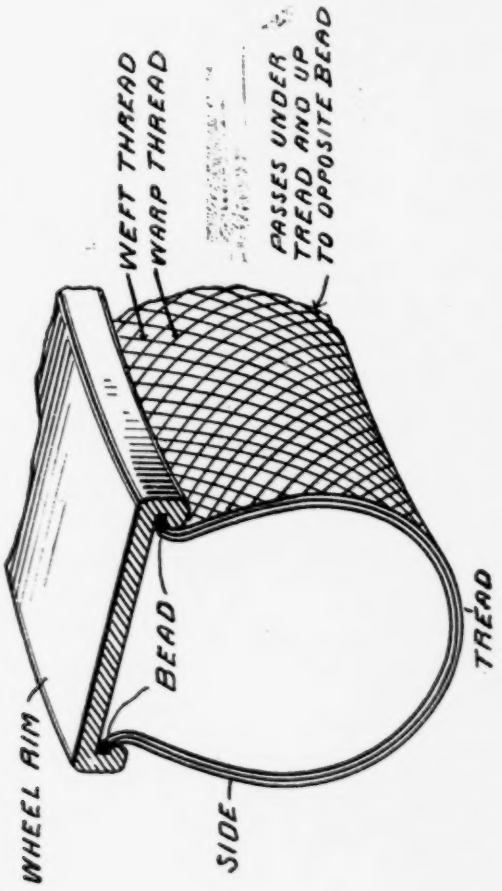


MACHINE STITCHER WHEEL

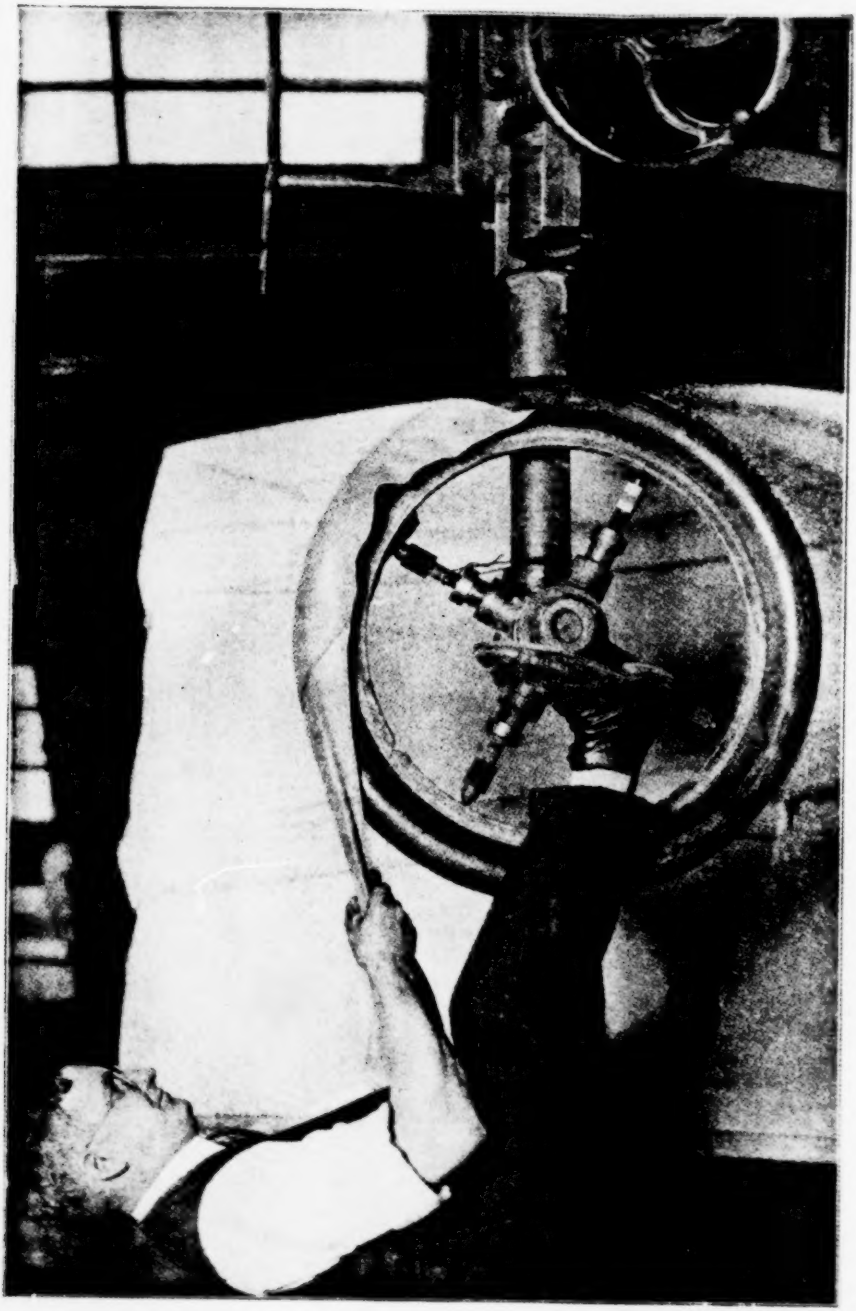


MACHINE STITCHER WHEEL

Plaintiff's Exhibit No. 10—Diagram of Carcass and Wheel Rim.

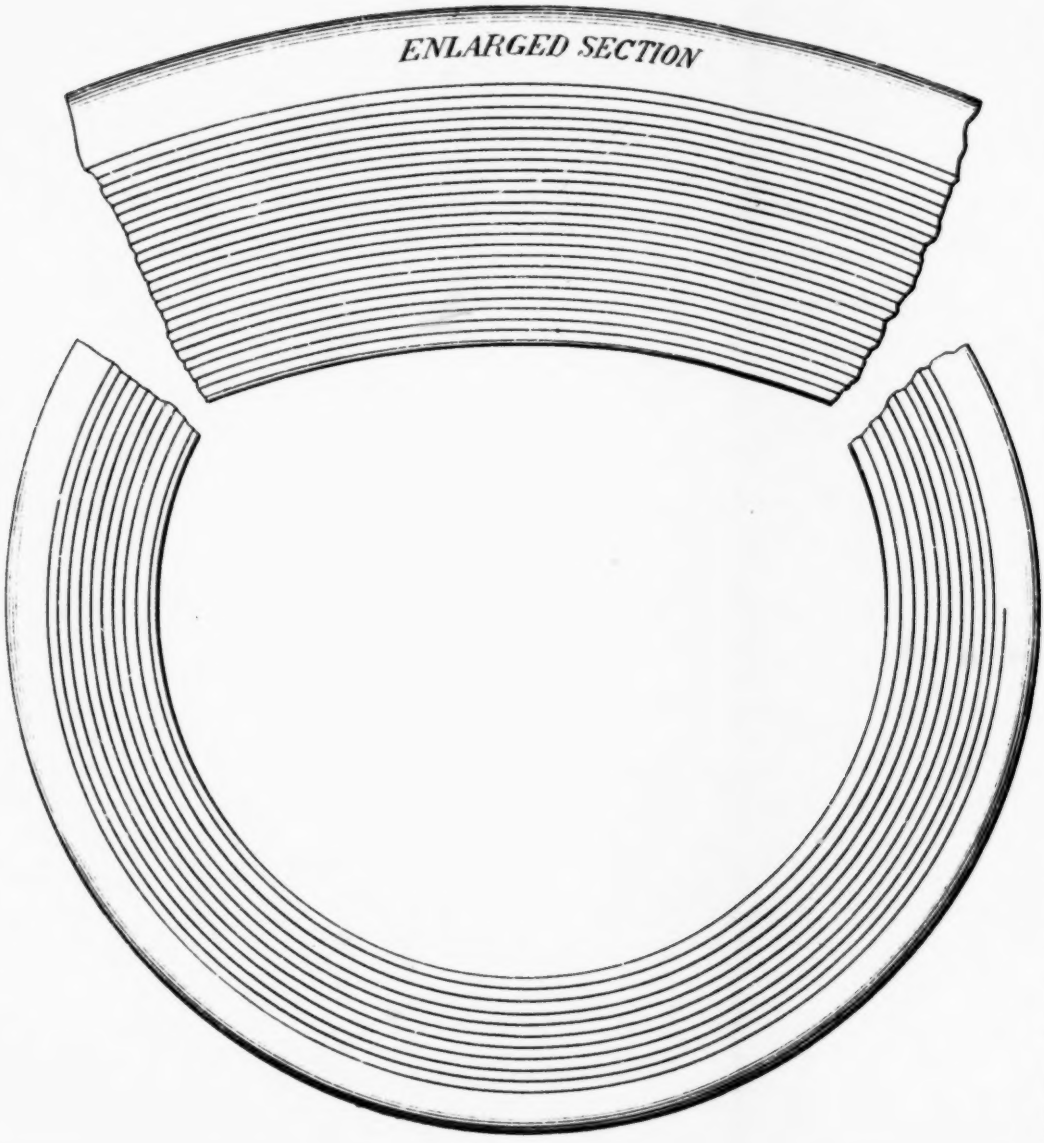


Plaintiff's Exhibit No. 11—Manual Circumferential Stretching.



Plaintiff's Exhibit No. 12.

STATE'S SPIRAL PATH



Plaintiff's Exhibit No. 13—Stevens Patent (1,253,105).

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 1.

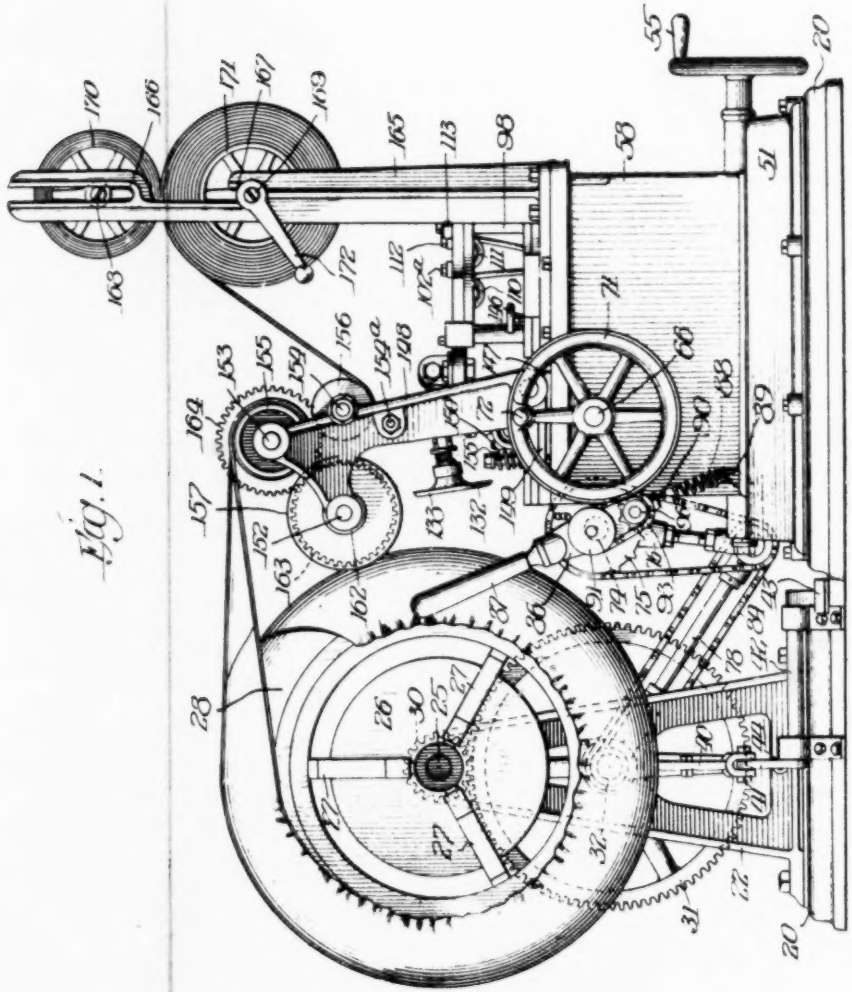


Fig. 1.

Witnesses
Ted G. Lanman
Louis Bruest

Inventor:
William C. Stevens
By Lunt, Bakewell & Fuller
Attys

108

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 2.

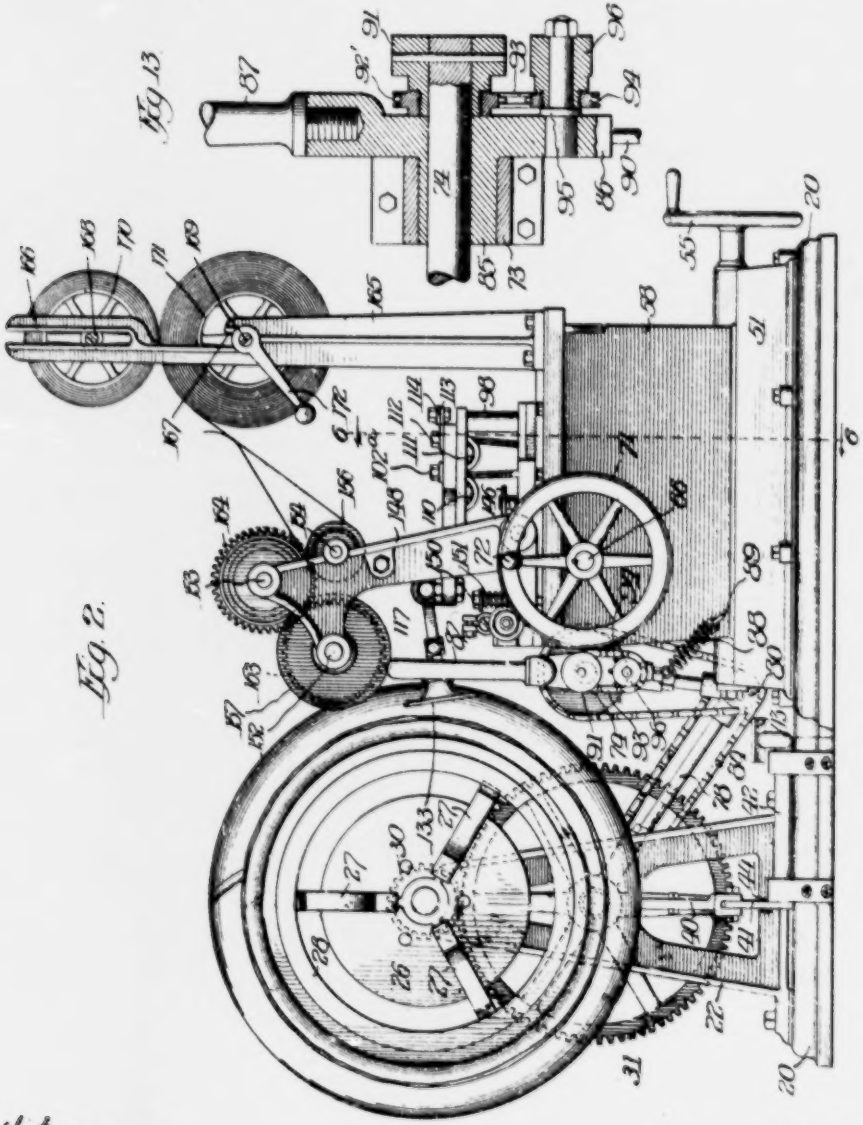


Fig. 2.

Witnesses
Fred C. Dyrion
Laura B. Priest

Inventor
William C. Stevens
By Lothrop Pitt & Hutter
Attys.

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 3.

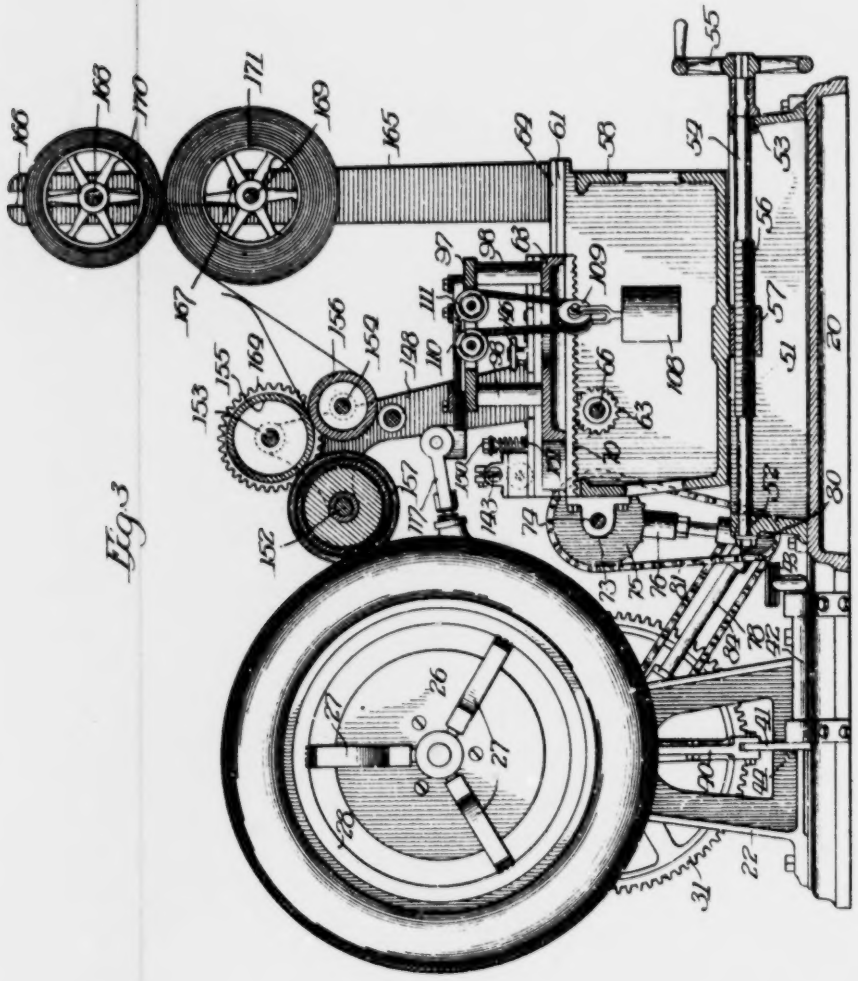


Fig. 3

Witnesses:
Fred Harrison
Louis J. Geist

Inventor:
William C. Stevens
By Smith Brown Gelt & Fuller Attys.

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 4.

Fig 15.

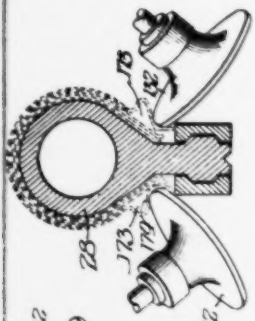


Fig 12.

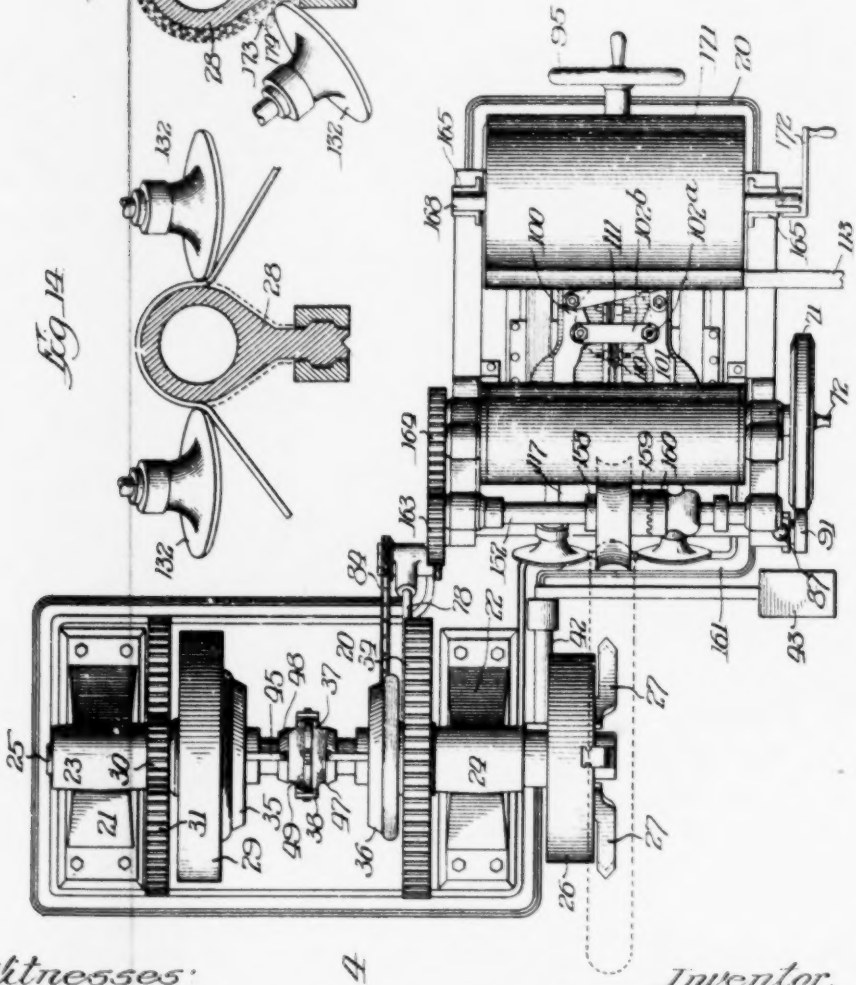


Fig 4

Witnesses:

Fred. C. Dannon

Louis D. Geist

Inventor.

William C. Stevens

by Smith & Dalton & Fuller

Attys.

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 5.

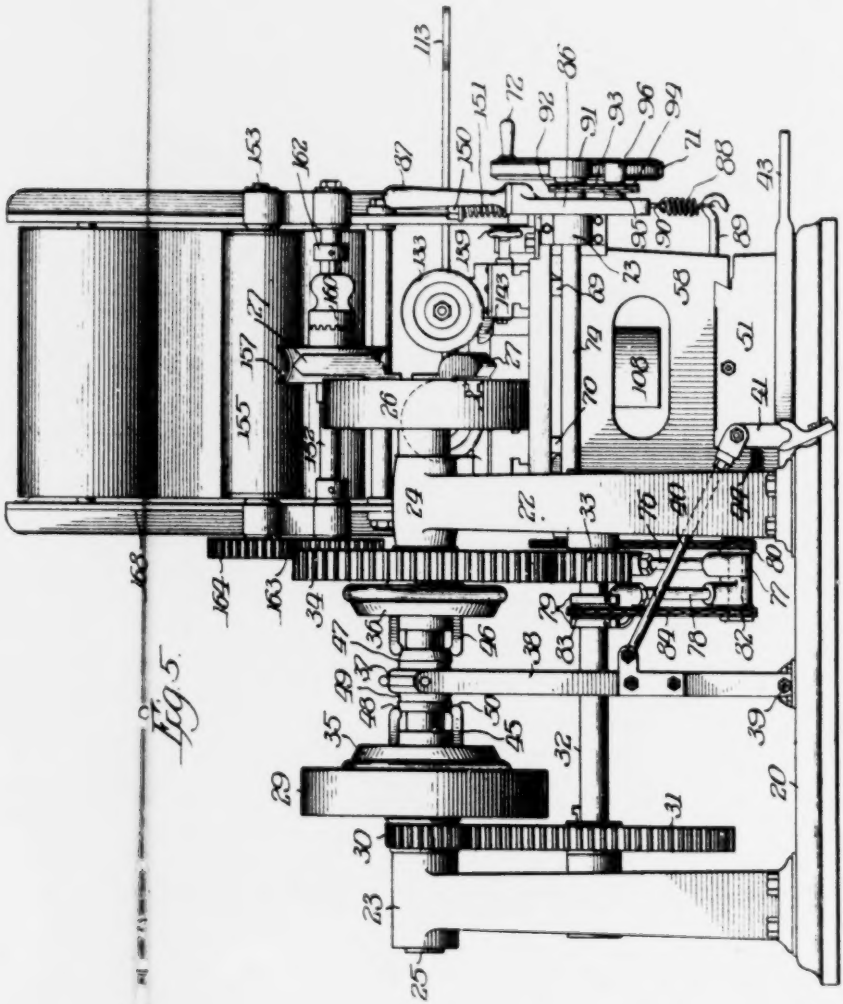


Fig 5.

Witnesses:
Geo. C. Lawson
David D. Geist

Inventor
William C. Stevens.
By Smith, Brown, Deb & Fuller Attys

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

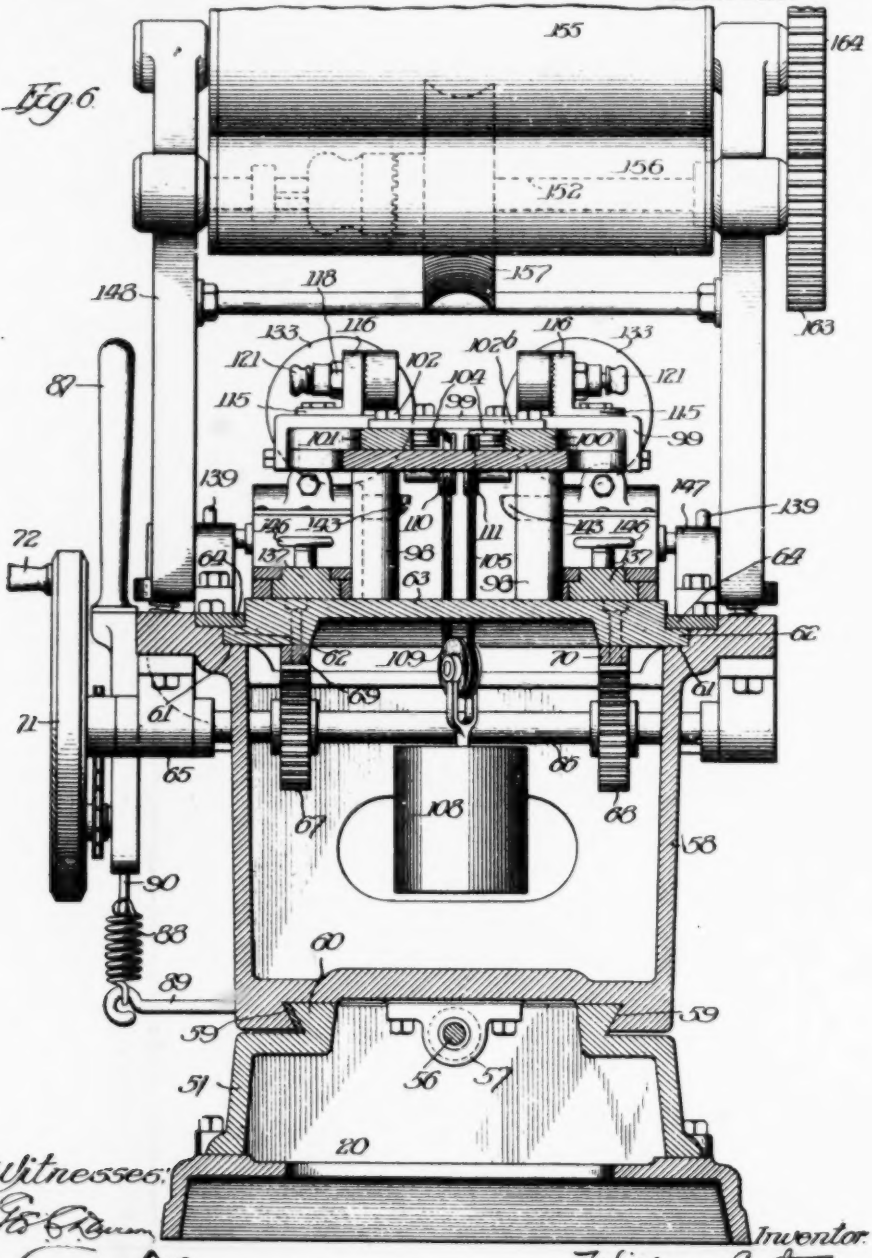
APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 6.

Fig 6.



Witnesses:

Inventor:

William C. Stevens

By Lothrop & Fuller

W. C. STEVENS.

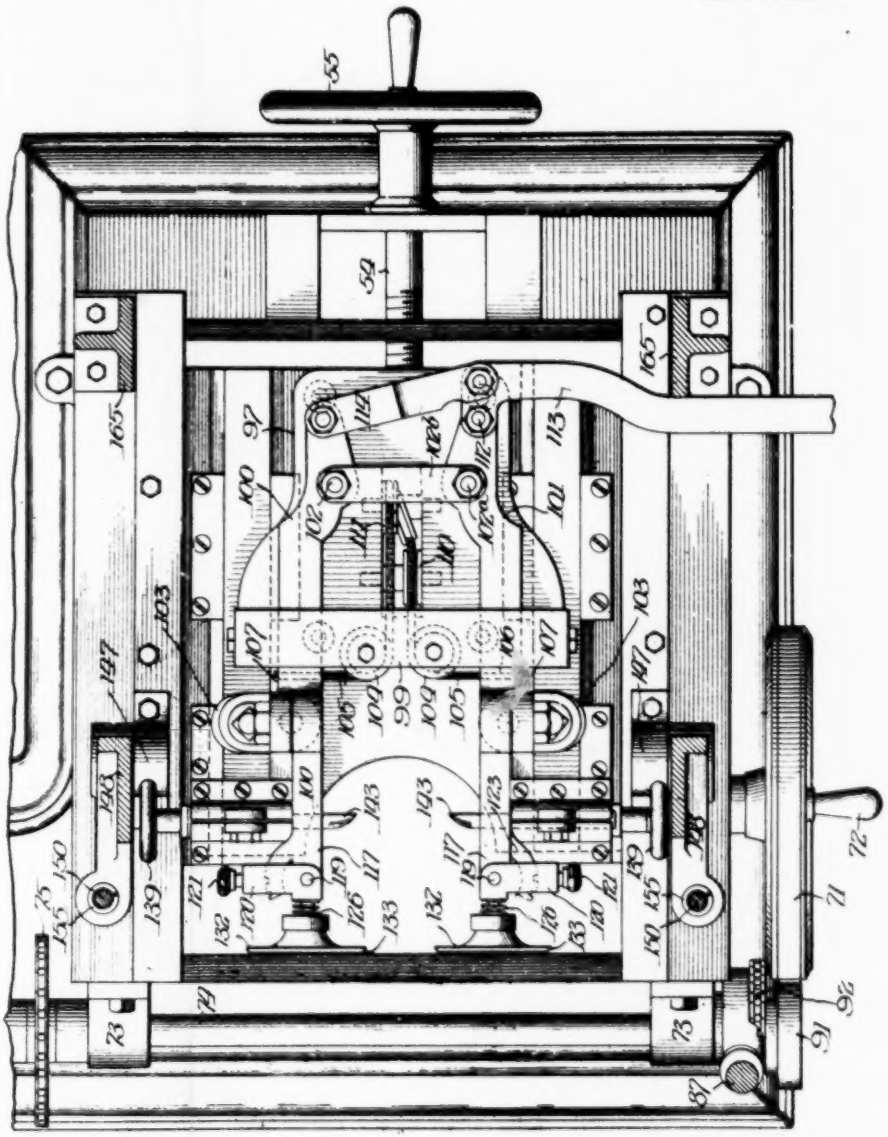
MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 7.



Witnesses:
Geo. C. Thomas
Louis D. Frost

Fig 7

Inventor:
William C. Stevens.
By Luther Cunn Dyer & Fuller
Attys.

W. C. STEVENS.

MACHINE FOR MAKING TIRE CARCASSES.

APPLICATION FILED APR. 12, 1913.

1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 8.

Fig. 8.

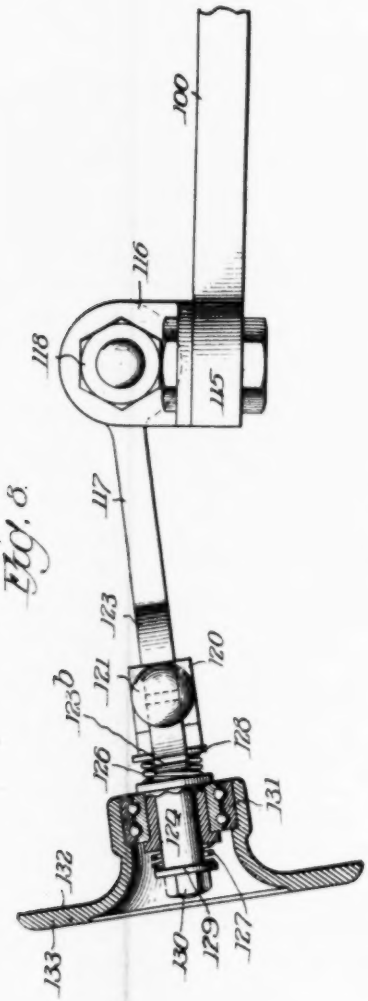
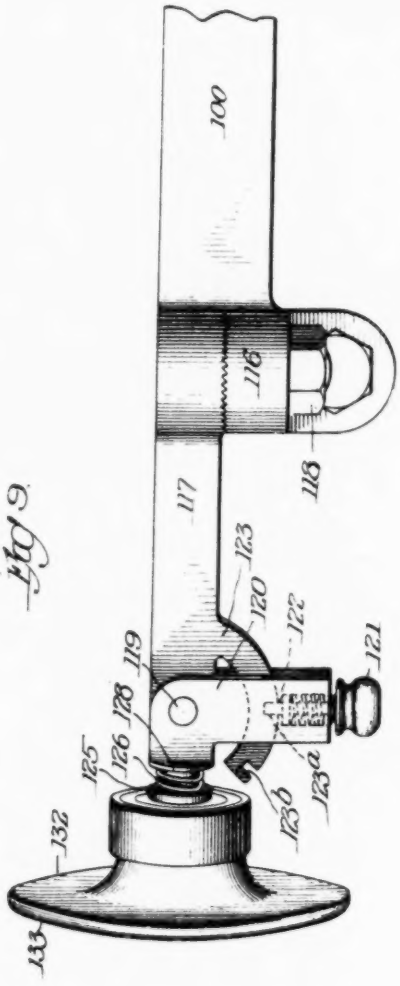


Fig. 9.



Witnesses
Fo. C. Lawson
Lewis S. Sweet

Inventor.
William C. Stevens
by Lothrop Bliss & Fuller
Attys.

50

5

W. C. STEVENS.

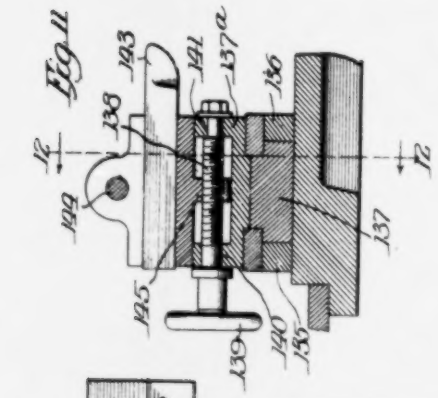
MACHINE FOR MAKING TIRE CARCASSES.

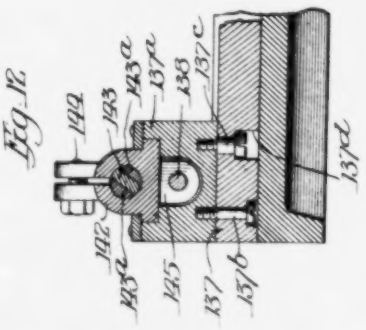
APPLICATION FILED APR. 12, 1913.

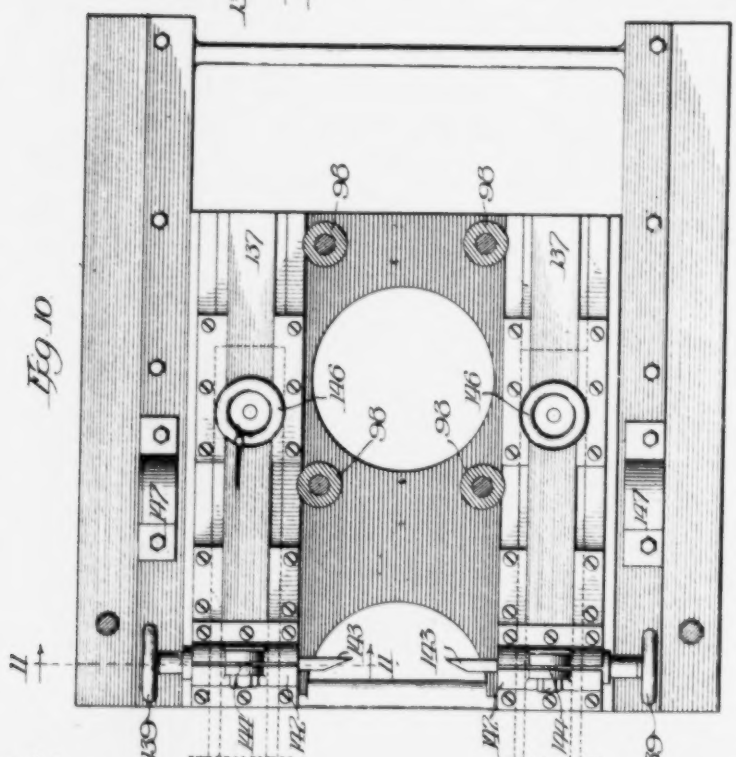
1,253,105.

Patented Jan. 8, 1918.

9 SHEETS—SHEET 9.







Witnesses:
F. C. Dawson
Louis B. Greist

Inventor:
William C. Stevens
By Lauttmann Dale & Fuller, Atty's

UNITED STATES PATENT OFFICE.

WILLIAM C. STEVENS, OF AKRON, OHIO, ASSIGNOR TO THE FIRESTONE TIRE & RUBBER COMPANY, OF AKRON, OHIO, A CORPORATION OF OHIO.

MACHINE FOR MAKING TIRE-CARCASSES.

1,253,105. Specification of Letters Patent. Patented Jan. 8, 1918.

Application filed April 12, 1913. Serial No. 760,615.

To all whom it may concern:

Be it known that I, WILLIAM C. STEVENS, a citizen of the United States, residing at Akron, in the county of Summit, State of Ohio, have invented certain new and useful Improvements in Machines for Making Tire-Carcasses, of which the following is a specification.

This invention relates to appliances employed in the making of automobile, motorcycle, and similar tire-casings, or shoes, and concerns more particularly means for applying to and shaping on an annular rotatable tire-core, successive layers or plies of adhesive rubber-impregnated or frictioned tire-fabric, in such manner that the plies will all be stretched with proper uniformity to the same degree regardless of their differences in dimensions and other physical conditions, to give each other in the completed tire-structure mutual support by reason of their cumulative and uniform capacity for resistance.

Heretofore, machines have been constructed in which the tread-portion of the tire-fabric has been overstretched in order to cause the ply to conform roughly to the contour of the core and to reduce the amount of fullness or surplus in the fabric to be cared for or absorbed at the sides of the core, but in the use of these devices, in addition to the objectionable and weakening excessive stretching, wrinkles and other defects have occurred in those portions of the fabric applied to the sides of the core, dependence being placed upon a subsequent elimination of such wrinkles, either wholly or partially. The resulting detrimental effects of these defects thus occurring are not, however, completely overcome by the subsequent removal or smoothing out of the wrinkles or folds. In the operation of my improved machine, although the fabric is stretched only the required amount to maintain the finished tire-shoe or casing in normal shape and with proper strength, nevertheless, in applying the fabric to the sides of the core, no wrinkles or similar defects are permitted to form. In other words, I avoid the effects of and presence of such defects in the completed tire-casing or shoe by preventing their occurrence as the fabric is smoothed down on to the form or core, rather than placing dependence upon an attempted elimination of such faults after they have occurred.

In addition, another aim of the invention is the production of a tire-carcass or casing in the manner indicated on a machine of simple structure having a novel disposition of the fabric-smoothing and applying elements, the labor cost of constructing the tire-casing or shoe being materially reduced, as well as providing a more generally uniform product with better wearing qualities than it has been possible heretofore to produce.

The fulfilment of these and other objects and purposes will be understood and appreciated by those skilled in this art from a consideration of the following detailed description of a machine of this character representing a preferred embodiment of the invention, such machine being illustrated in the accompanying drawings forming a part of this specification, and to which reference should be made in connection with the specification.

In these drawings:

Figure 1 is a front view of the machine showing the parts of the mechanism in their positions during the fabric-stretching operation;

Fig. 2 is a similar view showing the positions of the parts during the fabric-smoothing and applying operation;

Fig. 3 is a longitudinal section through the machine, the parts being in the same position as illustrated in Fig. 2;

Fig. 4 is a plan view of the machine;

Fig. 5 is an end elevation;

Fig. 6 is an enlarged vertical cross-section on line 6—6 of Fig. 2.

Fig. 7 is an enlarged horizontal section;

Fig. 8 is a fragmentary elevation partly in section of one of the fabric-smoothing rollers and its support;

Fig. 9 is a plan view of the construction shown in Fig. 8;

Fig. 10 is a horizontal section illustrating the mountings for the trimming-knives;

Fig. 11 is a section on line 11—11 of Fig. 10;

Fig. 12 is a section on line 12—12 of Fig. 11;

Fig. 13 is a section through the eccentric bearing for one end of the shaft 74, and

Figs. 14 and 15 are sections illustrating the action of the fabric-applying rollers on the fabric.

Referring to these drawings, it will be

apparent that this machine is composed of two coöperating parts—one, the mechanism for supporting and rotating the chuck or spider and tire-form or core, and the other, the means for applying the plies of frictioned or similar tire-fabric to such form. I will first describe the construction of the form-supporting and revolving mechanism and then the fabric-stretching and applying means.

Rising from one section of a right-angle base 20, (Figs. 4 and 5), is a pair of standards or pillars 21 and 22, having at their upper ends alined bearings 23 and 24 accommodating a shaft 25 carrying at one end a universal expansible chuck or spider 26 equipped with three arms 27, adapted to engage and support the usual tire-form or core 28 on which the tire-casing or carcass is built up by the application of a plurality of plies of frictioned or adhesive tire-fabric. The form and style of this expanding-chuck is, of course, immaterial, so long as the tire-form or core can be readily applied thereto and removed from it with facility and despatch. In this art, the body of superposed layers or plies of adhesive rubber-impregnated fabric before the completion of the casing or shoe by applying thereto the tread and other parts, and the curing of the tire, is known as a carcass.

Between the bearings 23 and 24, shaft 25 has loosely mounted thereon a driving-pulley 29 rotated from any source of power, as by a belt, (not shown). Fixed to such pulley at one side thereof and also loosely rotatable on said shaft, I provide a pinion 30 meshing with a gear 31 keyed to a lower shaft 32 revoluble in suitable bearings in the standards 21 and 22. Shaft 32 is also equipped with a pinion 33 in mesh with a gear 34 loose on shaft 25, this train of gearing constituting the well known back gearing provided for a reduction of speed.

Pulley 29 is supplied with a clutch-mechanism 35, gear 34 also having a clutch device 36, either of which may be thrown into action by the shifting of a central common clutch sleeve 37 slidable in either direction on the shaft 25 by means of a yoke 38 pivoted to the base at 39 and connected by a link 40 with the crank-arm 41 upstanding from one end of a suitably journaled rock-shaft 42 having connected at its opposite end a pedal or foot-piece 43. In order to hold the yoke 38 and the slidable clutch-sleeve 37 in neutral or inoperative position, that is, centrally between the two clutch devices, with neither clutch active, I interpose between the arm 41 and the adjacent standard a coil-spring 44. Clutch 35 is provided with a plurality of arms 45 projecting in the direction of the sleeve 37 and the companion clutch 36 has similar arms 46. In order to expand these latter arms, the adjacent portion of the sleeve 37 is beveled at 47, and the other end of the sleeve 37 is likewise beveled or tapered at 48 and is in addition supplied with an annular recess 49 adapted to receive the enlarged ends 50 of arms 45, such co-action of the arms with the groove acting to retain the clutch-sleeve in its lefthand position as the parts are viewed in Fig. 5, against the retracting action of spring 44.

When it is desired to rotate the chuck and form or core slowly, during the application and stretching of the tread-portions of the plies, the operator steps on pedal 43, causing a shifting of the sleeve 37 to the right, as viewed in Fig. 5, rendering the clutch 36 active to couple gear 34 to shaft 25, bringing about a relatively slow rotation of the latter. When the operator desires to revolve the chuck and core more rapidly, as during the rolling down of the fabric and the trimming operation, he lifts the pedal 43 against the action of spring 44 by placing his toe beneath it, causing a sliding of the sleeve 37 to the left, thereby rendering clutch 35 active and maintaining the same in such condition because of the retention of sleeve 37 in the shifted position by the engagement of the enlarged ends 50 of the arms 45 in the groove 49. As will be readily understood, under these conditions, shaft 25 will be rotated rapidly because the pulley 29 is directly clutched thereto. To stop the rotation of the chuck and form for the removal of the core and carcass, for example, the operator presses gently on the pedal 43, permitting the sleeve 37 to come to neutral position, in which it will be maintained by the action of spring 44. If the operator desires to stop the rotation of the core after the completion of the stretching operation, he merely lifts his foot from the pedal and the latter will automatically rise to neutral position so that neither clutch will be operative.

The other portion of the right-angle base 20 has bolted thereto a hollow box-section 51 having journaled in its end-walls at 52, 53, the cylindrical end-portions of a shaft 54, which projects out of the box 51 at one end, the protruding portion having fastened thereto a handle 55 of any suitable form, (Fig. 3). The central section of shaft 54 is slightly enlarged and screw-threaded at 56, such part passing through a similarly threaded bearing or box 57 bolted to the bottom surface of a hollow box slide or carriage 58, shaped at 59, 59, (Fig. 6), to fit over and coöperate with the longitudinal dovetail-shaped rib 60 on the top of the supporting box-section 51. In its top, (Fig. 6), this carriage or main slide 58 is provided with a pair of guideways 61, 61, slidingly receiving the marginal guiding-ribs 62, 62, of an upper slidable-carriage 63, the ribs 62 being held in the guideways 61, 61, by suitable retaining-bars 64, 64, overlapping them and

bolted in place to the member 58. The latter has externally fastened thereto a pair of depending bearings 65, 65, rotatably accommodating a cross-shaft 66 supplied internally of the hollow-slide or carriage 58 with a pair of gears 67 and 68, the teeth of which mesh with those of two inverted racks 69 and 70 fastened to the bottom surface of the carriage 63, whereby the latter may be advanced and retracted. At the front of this machine, shaft 66 has fastened thereto a friction drive-wheel 71 equipped with a handle 72, which permits of the manual rotation of shaft 66 and the resulting travel of the slide 63, as will be obvious. In order to permit a power rotation of the shaft 66, I mount at the inner end of the hollow member or slide 58, bearings 73, in which is adapted to revolve a transverse-shaft 74 carrying at its inner end a sprocket-wheel 75 and one end of a spacing-link 76, (Figs. 1 and 3), which at its lower end is pivotally connected by a short-shaft 77 to the lower end of another spacing-link 78, the upper end of the latter being bifurcated at 79, (Fig. 5), and adapted to rock on shaft 32. At one end of shaft 77 I employ a sprocket-wheel 80 connected to the sprocket-wheel 75 by sprocket-chain 81, and at the opposite end of shaft 77 I employ a similar sprocket-wheel 82 operatively connected with another sprocket-wheel 83, fixed to shaft 32 between the arms 79, by means of a second sprocket-chain 84. It should be apparent from this construction that the shaft 74 is at all times rotated at a uniform speed through power delivered from the jack-shaft 32 by means of the sprocket mechanism described, the elbow or link connection permitting, as will be readily understood, the sliding of the carriage 58 back and forth without breaking or interfering with the shaft-driving connection referred to. In other words, the sprocket mechanism is capable of extension and contraction to accommodate itself to the position of carriage 58 and shaft 74.

Shaft 74, instead of being directly mounted in the bearing 73 at the front of the machine, is rotatably received in an apertured boss 85, (Fig. 13), forming a part of a lever 86 and rotatable in the bearing 73, the shaft-receiving aperture extending through the boss and lever being eccentrically disposed with relation to the cylindrical exterior of the boss. At its upper end, the lever 86 has fastened thereto an operating-handle 87, the combined lever and handle being held in normal position by a coil-contractile spring 88, (Fig. 1), secured at its lower end to a stud 89 projecting outwardly from the carriage 58, the upper end of the spring being fastened by means of an eye 90 to the lower end of the lever. At its forward end shaft 74 has fixed or pinned thereto a friction-roller 91 adapted by manipulation or rocking of the combined handle and lever 87, 86, to be thrown into and out of driving peripheral frictional engagement with the wheel 71 on shaft 66, and by this means the rotation of shaft 74 can be transmitted to shaft 66 to slide the carriage 63 and the various parts carried thereby described hereinafter.

Fixed to the hub of roller 91, (Fig. 13) between the lever 86 and the friction-roller, I provide a sprocket-wheel 92 co-acting with which is a sprocket-chain 93 passing around another sprocket-wheel 94 fixed to the hub of a smaller friction-roller 96 revoluble on a stud 95 secured to the lower end of lever 86. The roller 96 is also adapted by the rocking of the handle 87 in the opposite direction to be thrown into and out of frictional engagement with the edge of wheel 71, its rotation being derived by the mechanism described from the shaft 74. By means of these two rollers 91 and 96, the operator, by manipulation of the handle 87 may impart two different speeds of rotation to the shaft 66, which, of course, means two different speeds of advance of the carriage 63 and the parts mounted thereon.

A plate 97 is mounted on the carriage or slide 63 some distance above the same, by means of a plurality of supporting posts or pillars 98, and has fastened thereto and extended across the top of the same, a bridge-piece 99 beneath which is a pair of shaped bars or arms 100 and 101 fulcrumed on a pair of studs 102 and 102^a on the plate 97 and connected together above the arms by a strengthening cross-bar 102^b, each of the arms 100 and 101 having at its forward end an outward laterally-offset slotted-ear 103, (Fig. 7). This bridge-piece 99 on its under side and near its center, carries a pair of suitably mounted revoluble grooved pulleys or sheaves 104, 104, passing around which is a cord or cable 105, the two ends of which extend through holes 106 in the pair of arms 100′ and 101, the ends of the cord being knotted at 107 to prevent their withdrawal through the holes. This cord 105 supports a weight 108 provided with a supporting pulley 109, (Fig. 6), the cord also passing over two suitably arranged and properly supported pulleys 110, 111 disposed in vertical planes, as shown in Fig. 7. It should, therefore, be clear that the weight of the member 108 is imposed equally upon the two arms or bars 100 and 101, tending to draw them together, yet permitting each to have an independent individual movement and at all times, the pull on the two bars will be equal and unvarying. On the bar or arm 101 at 112, (Fig. 7), I fulcrum the short leg or end of a right-angle handle 113, and I connect such handle with the companion arm 100 by means of a link 114 pivoted to each,

Each of the slotted ends 103 of the fulcrumed arms 100 and 101, has adjustably bolted thereto a right-angle bracket 115 having an upstanding portion or ear 116 with a roughened face against which is held the end of an arm 117 in such manner as to be capable of vertical angular adjustment, the arm being held or maintained in the desired position by means of a bolt 118 passing through the parts 116 and 117. As is described hereinafter, each of these arms 117 carries at its other end a fabric-smoothing and applying roller, and this angular adjustment of the arm permits the roller to be tilted in a plane oblique to the path of rotation of that portion of the core being acted upon by the roller. In ordinary operation, these arms slope downwardly slightly to secure this desired tilting or obliquity of the roller.

Each of the arms 117 has pivoted thereto at 119 near its end, a right-angle member 120, one leg of which is equipped with a spring-pressed locking-detent 121, the inner end 122 of which is adapted to co-act with two notches 123^a, 123^b, in a sector 123, integral or rigid with the arm 117, such construction of parts permitting angular adjustment of the member 120 in two positions, as will be readily understood. The other leg of the right-angle member has a cylindrical portion 124 mounted on which I employ a sleeve 125 received between a pair of coil-springs 126 and 127 encircling the shaft 124, each spring bearing at one end against an end of the sleeve 125 and at its other end against a washer 128 or 129, the latter and associated parts being held in proper assembled relation on the shaft 124 by a nut 130 secured on a reduced threaded end of the shaft. The sleeve 125, (Fig. 9), carries a ball-bearing 131 for a fabric-smoothing roller 132 of peculiar disk-like formation, the working-edge portion 133 of such roller being curved in approximately the form illustrated. As is clearly shown, the hub-portion of this roller houses and covers its ball-bearing and associated parts of the mechanism. The recess in the front face of the roller enables me to bring the nut 130 and other parts inwardly of such face so that the face is practically an unobstructed plane.

The member 120, as has been explained, is capable of angular adjustment in two positions around the stud 119, permitting the plane of the roller to be shifted as required, and the plane of such roller is perpendicular to the general plane of the core, being held in such position by the detent 122 engaging notch 123^a, except when shifted as described hereinafter.

The carriage or slide 63 is not only apertured at 134 for the passage therethrough of the weight-supporting cord or cable 105, the weight being received within the member 58, but it is also equipped at each side with a pair of guideway-members 135 and 136 acting as guides for a pair of slides 137. Each of such slides at its inner end carries a knife-holder 137^a angularly adjustable on the slide around a screw 137^b and capable of being held in adjusted position by a tightening-screw 137^c, which passes through a slot 137^d in the slide 137. Each of the knife-holders 137^a has a transverse rotatable screw 138 supplied with a turning-handle 139, cylindrical portions of such screw being rotatable in suitable bearings 140 and 141 in the holder. Each holder also carries a split-clamp 142 provided with a cylindrical aperture therethrough for the accommodation of a trimming-knife 143 and two segments 143^a disposed on opposite sides of the knife and permitting an angular adjustment of the knife about its own axis in the clamp, the knife and segments being held in adjusted position by means of clamp-tightening screw 144. This clamp has a depending screw-threaded ear 145 through which the screw 138 passes, permitting transverse movement of the knife relatively to the slide 137 by turning the handle 139. In order that these slides may be fixedly held in proper adjusted position lengthwise of the guideways in which they are received, each has a set-screw 146 with a suitable handle for its tightening and loosening.

As is clearly shown in Fig. 10, the two knives 143, 143, extend inwardly toward one another and are adapted to be fed inwardly to trim off the surplus fabric at the inner edges of the finished carcass.

Also on the sliding-box or member 58, in suitable bearings 147, 147, I hinge two side-members 148 of a carriage or rocking-frame, each of such members having at its lower end a laterally-extended apertured arm 149 through the hole of which passes a screw 150 threaded at its lower end into a correspondingly threaded hole in the slide or carriage 58, and encircling such screws between their heads and the legs or arms 149, I employ coil compressing-springs 151 tending to rock the frame or carriage, composed in part of the side-members, in a direction toward the core. These two-side members are connected together by a pair of tie-rods 154 and 154^a on the former of which is loosely rotatably mounted a fabric guide-roller 156. Each of these side-members has bearings for two cross-shafts 152 and 153, the latter having fixed thereto a stretching drum 155 supplied with a friction-surface such as would be provided by applying to the drum a layer of rubber-impregnated frictioned fabric, such as is used in the building-up of the carcasses. Shaft 152 has loosely mounted thereon and centrally thereof, a retarding or checking-roller 157 with a soft-rubber

concave-face shaped to conform substantially to the curvature of the face of the tire-core 28. This roller bears against a collar 158 fixed to the shaft at one side thereof, and has fastened to its opposite face one toothed member 159 of a clutch mechanism, the companion member 160 of which is similarly toothed and provided with a handle 161, such member 160 being splined to and slidable on the shaft 152 so as to be capable of clutching the roller 157 to the shaft and unclutching it therefrom. The outward movement of the clutch-member 160 is limited by means of another collar 162 fixed to the shaft. When the roller 157 bears against or presses on the tire-core or the fabric-plies applied thereto, owing to the frictional engagement between the parts, they both have the same surface speed. In order that the stretching roller 155 may positively and uniformly travel at a surface speed different from that of the checking-roller 157, I employ a gear 163 on the end of shaft 152, which meshes with the gear 164 on the end of shaft 153 and so choose the size of the gears and the diameter of the stretching-roller that each ply will be given a definite uniform stretch throughout its central part.

On the carriage or slidable box 58, at one end, I mount a pair of upright standards 165, each provided with a pair of slotted bearings 166 and 167 for the reception of the ends of shafts 168 and 169 carrying the drums 170 and 171 respectively, the former being adapted to have wound up thereon the usual cotton cloth liner separating the plies on the drum 171 as such liner and plies are unwound from the latter drum. This upper drum 170 and as much of the liner as has been wound thereon, rest directly on the surface of the combined frictional plies and liner wound on the supply-drum 171 in a common and well known manner, so that as the latter is revolved to draw off a fabric ply the drum 170 is similarly rotated to wind up the liner thereon. Shaft 169 is equipped with a detachable handle 172 for a purpose hereinafter indicated.

The operation of this machine takes place substantially as follows:

The operator places in the bearings 167 a shaft 169 carrying a drum 171, having wound up thereon in proper sequence the supply of plies of rubber-impregnated or frictioned fabric, the layers of which are separated from one another by the ordinary cloth liner to prevent them from adhering to one another. As is usual in this art, these plies vary slightly both in length and width, the shortest and narrowest ply being the first to be placed on the core and the longest and widest ply being the last one to be applied to the carcass, this difference in length and width being required because of the gradually increasing diameter of the carcass both circumferentially and crosswise and also because the latter plies are placed over the beads. As is usual, these plies are cut on the bias to permit the adhesive rubber-impregnated fabric of the ply to be stretched lengthwise throughout its central part as it is placed on the form or core, for several purposes, among which is the reduction of the amount of fabric which must be pressed or condensed on the sides of the form to avoid wrinkles and similar imperfections.

The man having the machine in charge places the tire-form or core 28 on the universal expansion-chuck or spider 26 and expands or elongates the arms 27 so as to securely retain the core thereon, compelling rotation of the form or core with the shaft 25. Then the workman, by turning the handle 55, advances the carriage or slide 58 toward the form or core until the face of the checking-roller 157 engages the core, and then he turns the handle 55 still further, causing the carriage to advance somewhat more, bringing about a rearward rocking of the carriage or frame 148, 148, 154 and 154^a in the bearings 147 until the feet 149 are raised slightly above the carriage 63 against the downward pressing action of springs 151, such elevation of these feet indicating to the operator the proper position of the carriage. The slide 58 and appurtenant parts remain in this position until the carcass is completed.

Now the workman draws the advance or front end of the first ply of fabric from the supply roll, passes it beneath the loose guide-roller 156 and over the retarding or stretching roller 155, and causes its front end, which is cut off diagonally, to adhere to the form by means of cement, it being understood that the ends of the various plies of fabric on the supply drum are overlapped and thereby temporarily spliced together so that as each ply of fabric is stretched on the core the next succeeding ply assists in the stretching operation, forming an elongation or extension of the ply which is being stretched. In other words, the ends of the adjacent adhesive plies wound up on the supply-drum 171 are stuck together so as to constitute a continuous length of material separable into plies or sections, however, as required.

The person in charge of the machine steps on the pedal 43, throwing the clutch 36 into action, causing a relatively slow rotation of the shaft 25 and the core by means of the back-gearing 30, 31, 32, 33 and 34. During such rotation of the form or core, the clutch-members 159 and 160 are in operative engagement, whereby the rotation of the stretching roller 155, which has a tendency owing to the fabric passing over it to revolve at the same surface speed as the core is checked or restrained by the frictional engagement of the retarding or checking-

roller 157 with the surface of the core. In other words, the roller 155 tends to rotate more rapidly than it actually does, the roller 157 being prevented from more rapid rotation owing to its frictional and checking engagement with the face of the core. Driving contact of the retarding or checking roller 157 with the surface of the core is obtained by the pull of the fabric exerted by the core in its rotation and also by the weight of the hinged frame carrying the stretching mechanism. Because of this positive, uniform, slower, surface speed of the stretching roller 155, and because of the fact that the core is rounded in cross-section, the central zone or middle portion of the fabric ply is stretched longitudinally uniformly throughout its length, and is at the same time, stretched somewhat cross-wise, causing it to adequately, smoothly, and properly adhere to the outer or tread-portion of the core, requiring no rolling or further shaping treatment. This rotation of the core, of course, automatically unwinds the ply and a part of the next succeeding ply from the supply-drum 171.

When the core has completed one revolution, the operator removes his foot from the pedal 43, which automatically swings up under spring action, throwing the clutch 36 out of operation, that is to say, the rotation of the form or core stops, and, during such cessation in the rotation, the man breaks the overlapping splice between the last end of the first ply and the advance end of the second ply, and by means of the handle 172 on the shaft of the supply-roller, rewinds on the latter a portion of the second ply and its liner, the remainder of the second ply being temporarily folded back over the roller 156 out of coöperative relation with the stretching-roller 155.

The first ply of adhesive fabric having been thus stretched on the form and its two ends overlapped the required amount to form a proper splice or joint, it will be found that its central section corresponding to the tread-portion of the tire is shaped to and caused to adequately adhere to the form without wrinkles, air-bubbles or other defects, during such relatively slow rotation of the form and not by the action of the roller 157 which runs over a part of its surface, but rather by the stretching operation itself, the stretching not only elongating the central section of the ply but causing its proper application to the peripheral part of the form. It being understood that each ply is individually stretched on the core and then smoothed down into position on the sides of the core before the next ply is stretched and applied, the ply now on the form is ready for the application of its side-portions to the side faces of the core, such smoothing of the fabric causing its adhesion to the core being accomplished at a higher speed of rotation of the latter than that used during the stretching.

The sides of the form having been coated with cement to secure the proper attachment of the fabric thereto, the operator lifts the pedal 43 by placing his toe beneath it and thereby renders the clutch 35 operative, so that the shaft 25 and the core are rotated directly at a more rapid speed by the pulley 29. The man then by grasping the handle 113 and shifting it to the left separates the rollers 133, and by turning the wheel 71 by the handle 72, advances the carriage 63 until the rollers are opposite the places on the core at which they are to begin their operation. The operator releases handle 113 permitting the weight 108 to pull the rollers toward one another, that is, toward the core, with an equal pressure due to the action of weight 108. He then shifts the handle 87 to the right so as to cause the constantly rotating wheel 91 to frictionally engage the edge of wheel 71, and in this way mechanically and uniformly advances the carriage and rollers toward the axis of the core, these rollers, owing to the action of weight 108, readily following the contour of the core and being pressed toward the core under equal pressures uniformly throughout their traverse.

The core, as is usual in machines of this kind, during the smoothing-down action, is rotated quite rapidly as stated, and the effect of this rotation is to spread out somewhat skirtwise and substantially free from wrinkles, any unattached parts of the ply which is undergoing attachment. During this rapid rotation of the core the springs 151 are useful to prevent the roller 157 and the swinging-frame 148 from bouncing or jumping unduly as the roller passes over the overlapping ends of the ply. The shaping-rollers act upon the fabric just at the junctions of the skirtwise-spread, practically unwrinkled portions with the attached portions. Each of the shaping or smoothing-rollers as has been explained, is desirably tilted in a plane slightly transverse or oblique to the path of rotation of that zone of fabric which the roller is acting on, with the advance edge of the roller more remote from the axis of the core so as to effect an inward wiping, smoothing, and squeegee action on the fabric as it presses it down into place on the core or in the case of later plies, on one of the plies below. Due to this disposition or inclination of the rollers, the latter crowd or press the fabric as they apply it in the general direction of rotation of and progressively toward the center of the form, thereby efficiently and adequately condensing or compressing the fabric to prevent the occurrence of wrinkles, folds, or similar defects, in the applied ply.

Owing to the fact that the ply is cut on the

bias, this wiping action of the fabric-applying roller inwardly toward the axis of the core and also in the direction of rotation of the core, due to its tilted position, results in a stretching of the fabric radially or transversely of the core, thereby bringing about a circumferential contraction or shortening of the belt or zone of fabric acted upon by the roller, and the next adjacent belt or zone, in this way preliminarily preparing the latter for its application to an adjoining portion of the core naturally of somewhat lesser diameter. In this manner the roller progressively causes the adhesion of the fabric to the core, first shortening each zone or belt before rolling it down into place. It should be clear that such tilting of the roller not only stretches the fabric transversely of the core, but also condenses or compacts the fabric circumferentially to absorb the fullness.

The working-face of the stitching-roller is essentially that of a rounded edge. It must be sharp enough to produce under pressure the scraping or rubbing effect upon the fabric heretofore referred to, but it must not be sharp enough to cut or abrade the fabric. The fabric-shaping disk or roller should also have a diameter sufficient to give the effective line or tangent of contact a perceptible length, that is, this line of contact should be something considerably more than a mere point. My preferred form of fabric-shaping element is a disk with one face practically flat, the other face being substantially parallel to the first up to near the edge where it is sloped or rounded off to meet the first or back face. This enables the roller to work down closer and more effectively into and over the recess caused by the bead on the tire when the later plies of fabric are worked into place. At the same time, the rounded edge which progresses first in the inward movement of the tool enables me to meet the sharp curve of the bead and to shape and finish this off to good advantage and to prepare the fabric as indicated above for the completer work of the sharper edge. This arrangement of the edge I have found to be perhaps the best in practice. There is just enough dragging action owing to the tilt of the disk to stretch and smooth the fabric properly, while the edge instead of traveling in a line has a path of appreciable width. Its effect is thus better and more uniformly distributed over the fabric. In making tire-casings by hand the operator with one hand pulls or stretches the fabric at intervals toward the center of the core, while with the other hand he works the applying-tool, (a disk-like roller mounted in a handle), by a series of strokes directed tangentially and slightly inwardly on the face of the fabric covering the core, and thus tries to fit and smooth the fabric on the core. My device does this with uniformity and regularity, while the essentially different manually-performed series of acts just alluded to are apt to be more or less inaccurate owing to the possible vagaries and inattention of the operator and the uncertainties of his personal equation.

It will, of course, be understood and appreciated that the parts of this mechanism are so constructed and related to one another that during the inward travel or advance of the rollers from a position adjacent to the tread-portion to the inner part of the core, the latter makes many revolutions, the inward travel of the rollers being progressive and gradual so that they act in sequence upon successive zones or portions of the unapplied fabric to apply them or cause them to be attached to the core in the manner indicated above.

Instead of releasing the handle 113 during this fabric-applying action, the operator may retain such handle in his hand and augment the action of the weight 108 on the rollers, and by holding the handle, may steady somewhat the action of the rollers as they pass over the splices. This, however, is not absolutely essential since the weight itself can satisfactorily perform this function.

The rollers having reached the inner edges of the ply, the operator by means of the handle 113 separates the rollers and by releasing the handle 87 and manually turning the wheel 71 by means of the handle 72, the carriage on which the rollers are mounted is retracted out of operative position ready for the application and stretching of the second ply on top of the first ply. The man working the machine presses on the pedal, permitting it to resume its neutral position, thereby stopping the rotation of the core. He then takes the advance end of the second ply, brings it over the retarding roller 155 and presses it down by hand on top of the first ply. He then slides the clutch-member 160 into engagement with the companion clutch-member 159, the part 160 having been out of such co-action during the previous operation. He again steps on the pedal and brings about the slow rotation of the core during which the second ply is stretched on the core over the first ply in the same manner that the latter was stretched on the core. In attaching the advance end of the second ply to the first ply, the operator is, of course, careful not to cause an overlapping of splices on the tread-portion of the core. The second ply is stretched in substantially the same manner as the first ply, the rotation of the core then stopped, the splice or joint attended to, and the ply is then smoothed down in place on the sides by the rollers as was the first ply at the higher

speed of rotation of the core, bringing about a proper unwrinkled application of such second ply on top of the first, to which it adheres as will be readily understood.

This operation is repeated a sufficient number of times to build up the plies one on another until the desired thickness has been secured; then two circular beads 173, 173, (Fig. 15), are placed on the sides of the carcass under process of construction and caused to adhere thereto. The next ply of frictional fabric, after having been stretched over the underlying plies is rolled down by the disks or rollers in the same manner as the preceding plies until such rollers reach the beads. Then, owing to the rather abrupt curved surfaces of these beads it is desirab'e that the smoothing-rollers travel inwardly more slowly, and to effect this the operator shifts the handle 87 to the left as the parts are viewed in Fig. 2, bringing the smaller friction-roller 96 into contact with the edge of wheel 71 and the larger friction-roller 91 out of such contact. During such slower inward advance of the rollers over the beads, the operator, if he desires, although it is not absolutely necessary, may decrease the inward pulling-action of the weight 108 on such rollers by applying pressure on the handle 113 in opposition to the inward pull of the weight, and in this way all tendency to dislodge the beads is overcome and the application of the fabric to the underlying plies and to the bead itself neatly effected. It will be noted that owing to the tilted arrangement of the disks, they are given a tendency to traverse the rather steep faces of the beads, and this tendency is accentuated by the shape of the edge of the disks, so that the disks owing to these foregoing characteristics pass in their traverse easily over the faces of the beads, and smooth the friction fabric down upon the beads and settle the latter into permanent position on the sides of the carcass. Owing to the yielding mountings of these disks or rollers on their supporting fulcrumed arms, they may shift position somewhat axially, against the centering action of the opposed springs 126 and 127 and automatically accommodate themselves to any slight irregularities of the beads.

When these rollers reach the inner abrupt faces 174 of the beads, that is, the surfaces between the clench or heel and toe of the beads, the operator releases the handle 87, permitting it to automatically resume its neutral position as determined by the action of spring 88, throwing the friction-wheel 96 out of coöperative relation with the wheel 71. The angular adjustment of the rollers is then shifted to the position indicated in Fig. 15, the rollers or disks being held in their new adjusted position, as will be readily understood, by the coöperation of the catches or detents 121 with the notches 123^b. This shifting of the position of the rollers is done to permit them to accommodate themselves more efficiently to the surfaces on which they are about to act. By grasping the handle 72 the operator holds the shaft 66 from turning, that is, holds the carriage from movement, and then by manipulating the handle 113 the tilted rollers are fed directly in back of the beads, applying the fabric without wrinkles or other defects to the abrupt faces 174, the advance edges only, of the disks being operative.

After the required number of plies have been placed on the core in the manner indicated, both beneath and over the beads, the pair of slides 137 are adjusted and held in adjusted position by the set-screws 146, and then the trimming-knives 143 are advanced or fed inwardly toward one another by turning the screws 139 so as to trim off the surplus material at the inner side of the carcass, that is, at the toes of the beads. During this trimming-operation the form is revolved at the same relatively high speed at which the rolling down or smoothing of the fabric is done. Then the trimming-knives are retracted, the slides pushed back, the carriage 63 slid back, and the core and tire-casing or carcass thereon removed from the chuck ready for finishing and curing and the machine is now in condition for the reception of a new form or core. It might be observed, however, that owing to the universal adjustment of which the trimming-knives are susceptible, the trimming is accomplished with effectiveness and despatch.

It should be noted that in the actuation of this improved machine during the stretching-operation, the middle-section of each ply of fabric is stretched longitudinally a definite percentage of its original length, such stretching being occasioned by the pulling-action of the form and the retarding or holding back action of the roller or drum 155. Since the concave checking-roller, desirably made of soft rubber, travels on the surface of the form, or the outermost ply if several plies have been placed on the form, the stretching of the layer or ply of fabric being applied is determined by the length of the surface on which the roller travels so that a definite percentage of stretch is brought about in each ply regardless of its original length, the various plies varying in their original length, being preliminarily cut in accordance with the usual practice.

Owing to this manner of applying these layers or plies, the middle zone of each one is stretched uniformly throughout its length and with the same degree of stretch that is given to all other plies. In this way in the finished product, each ply reinforces the others and is in turn reinforced and strengthened by them in their pressure-re-

sisting qualities. The result is a carcass or tire-casing of remarkable strength and uniformity in its various characteristics.

Heretofore it has been proposed to use a friction band-brake to retard or brake the action of the stretching-roller, but these constructions have proved to be unsatisfactory in service owing to the lack of uniformity in the retarding-action of the brake on the roller, particularly when acting on plies of different temperatures. If the ply of fabric is being applied in a room relatively cool, a greater force or pull is necessary to obtain a certain degree of elongation or stretch, whereas if the same ply is stretched in a room of higher temperature the force necessary to stretch it is not so great, consequently, when a band-brake is employed it should be either adjusted to meet the different temperature requirements or else the amount of stretch in the plies will not be uniform. In my construction, however, owing to the positive connection between the stretching-roller and the retarding or checking-roller the amount of elongation given to each ply is necessarily the same percentage of its original length, the result being a tire-carcass possessing more uniform and greater strength than those heretofore produced.

To those skilled in this art, it will be apparent that some initial stretching of the fabric plies during the making of the tire-carcass is necessary in order to prevent undue enlargement or expansion of the casing or shoe when its inner tube is blown up, and it is carrying its load. It is important, however, that the plies should not be overstretched as has been customary in other tire-making machines which I am acquainted with, such undue stretching causing the casing to be weak when the load and pressure are applied, but on the other hand, if the plies are understretched the shoe or casing fails to keep its shape and to wear to the best advantage. This improved machine is so designed as to give the plies the proper percentage of stretch throughout their middle zones or sections. This, of course, means that a greater amount of fullness or surplus of stock must be absorbed in the sides of the tire than in those instances where the middle-portions of the plies are overstretched, but my mechanism efficiently applies the side-sections of the fabric plies to the core without defects, depending upon the principles of operation hereinabove outlined.

When plies are stretched on a core by hand, the workman grasps the edges of the ply and by pulling thereon causes an elongation or lengthening of the central section of the ply because of the rounded contour of the core, but he also at the same time stretches these side-sections which necessarily means an extra amount of fullness which must be condensed in the sides of the carcass. In this machine, however, the stretch of the side-portions is reduced to a minimum, thereby overcoming this obvious objection to hand-stretching.

Since my fabric-applying rollers are capable of yielding in practically all directions, their travel over the fabric and the splices is facilitated, without varying the pressure of the rollers on the fabric brought about by the action of a common weight on the two arms carrying the rollers. Another point of advantage in this construction is that the same rollers can be used on all parts of the tire, with the exception of the central section of the tread which is applied and caused to adhere in position during the application of the ply to the form, that is, during the stretching operation itself. It is also to be noted that another feature of superiority resides in the fact that no form-shields or shield-rollers are necessary for applying or guiding the fabric to the core. The structure of this mechanism is not only simple and inexpensive to produce, but the manufacturer is not required to have different machines for different sizes of cores and carcasses, because all ordinary sizes of tires can be made on one machine without adjustment or extra tools, it being merely necessary to use different forms or cores and pieces of frictioned fabric of appropriate size.

These machines can economically produce tire-casing carcasses because they can be operated at a relatively high speed, and although I provide means for reducing this speed of travel of the rollers over the beads, it should be borne in mind that such portions of the carcasses form a relatively small part of the whole, and it will be clear that the various parts of the carcass because of this change of speed, are built up and constructed with a maximum degree of economy of production.

While I have herein set forth with some degree of particularity and minuteness a description of the construction and operation of a preferred embodiment of this invention, it should be borne in mind that many mechanical changes may be made in the structure set forth without departure from the substance of the invention, and without the sacrifice of any of its substantial benefits and advantages. For instance, I have herein outlined a construction wherein the core or form revolves and the rollers remain relatively stationary, but of course, this operation could be reversed.

Whereas above I have described the fabric-applying roller as being tilted in a plane oblique to the path of rotation of the core at the point of action of the roller on the core, it is to be understood that this need be only a relative obliquity between the roller and such path of rotation, the essential feature

being to give the roller an effective action upon the fabric in a path of appreciable width to accomplish the result referred to.

Above I have stated certain theories regarding the action which the various instrumentalities of the mechanism bring about on the frictioned fabric, but these theories are to be considered as illustrative only of the action, and I do not wish to be strictly bound thereby since the results brought about in the fabric by the action of this machine are novel and unusual. While they afford a good working basis for an understanding of the operation of the machine they may not be wholly free from error and for that reason I do not wish to be restricted and necessarily bound to them.

I claim:

1. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying member located in a plane oblique to the path of rotation of the core at the point of action of such member on the core, and means to cause said fabric-applying member to travel in a spiral path over the core, substantially as described.

2. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying roller located in a plane oblique to the path of rotation of the core at the point of action of the roller on the core, and means to cause said fabric-applying roller to travel in a spiral path over the core, substantially as described

3. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying member located in a plane oblique to the path of rotation of the core at the point of action of the member on the core, means yieldingly pressing said member toward the core, and means to cause said fabric-applying member to traverse the side of the core in a spiral path, substantially as described.

4. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying member located in a plane oblique to the path of rotation of the core at the point of action of the member on the core, and means to feed said member inwardly toward the core-axis, whereby such member may act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, substantially as described.

5. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying member located in a plane oblique to the path of rotation of the core at the point of action of the member on the core, means yieldingly pressing said member toward the core, and means to feed the member inwardly toward the core axis, whereby said member may act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, substantially as described.

6. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying roller located in a plane oblique to the path of rotation of the core at the point of action of the roller on the core, means yieldingly pressing the fabric-applying roller toward the core, and means to feed the roller inwardly toward the core-axis during the rotation of the core, whereby the roller may act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, substantially as described.

7. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying member, means tending to move said member toward the core, means to feed said member inwardly toward the axis of the core, whereby the member acts on successive portions of the tire-fabric to apply the same to the core or a previously applied ply of fabric on the core, and manually-operable means to regulate the action of said moving means on said member, substantially as described.

8. In a tire-machine, the combination of a revoluble tire-core, a pair of fabric-applying rollers adapted to act simultaneously on opposite sides of the core, means to press said rollers toward the core during the entire application of the fabric, means to feed said rollers inwardly toward the core-axis, whereby the rollers act on successive portions of the tire-fabric to apply the same to the core, or a previously applied underlying ply of fabric on the core, and a manually-operable means adapted to regulate the action of said roller-moving means on said rollers, substantially as described.

9. In a tire-machine, the combination of a revoluble tire-core, a pair of fabric-applying rollers adapted to simultaneously act on opposite sides of the core, means common to both of said rollers acting to move them with an equal pressure toward the core during the entire application of the fabric, means to feed said rollers inwardly toward the core-axis, whereby the rollers act on successive portions of the tire-fabric to apply the same to the core or a previously-applied underlying ply of fabric on the core, and a manually-operable means to regulate the action of said moving means on said rollers, substantially as described.

10. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying roller, means to move said roller toward the core during the entire application of the fabric, means to exert on said roller a uniform pressure toward the core at all positions of the roller on the core, means to feed said roller inwardly toward the core-axis,

whereby the roller acts progressively on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, and manually-operable means to modify the action of said roller moving means, substantially as described.

11. In a tire-machine, the combination of a revoluble tire-core, a pair of fabric-applying members adapted to act simultaneously on opposite sides of the core, means common to both of said members to exert the same uniform pressure toward the core on both of the members at all positions of the latter on the core, means to feed said members inwardly toward the core-axis, whereby the members act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, and manual means to modify the action of said pressure-applying means on said members, substantially as described.

12. In a tire-making machine, the combination of a revoluble tire-core, a pair of fabric-applying members adapted to act simultaneously on opposite sides of the core, means common to both of said members to exert the same uniform pressure toward the core on both of said members at all positions of the latter on the core, means to feed said members inwardly toward the core axis, whereby the members act progressively on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, and manual means to modify equally the action of said pressure-applying means on both of said members, substantially as described.

13. In a tire-machine, the combination of a revoluble tire-core, a carriage, a pair of arms fulcrumed on said carriage, a fabric-applying member on each of said arms, means acting on said arms tending to move said members toward the core during the entire application of the fabric, means to advance said carriage and members toward the core axis, whereby the members may act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, and manually-operable means to rock said arms on their fulcrums, whereby to modify the action of said arm-moving means, substantially as described.

14. In a tire-machine, the combination of a revoluble tire-core, a carriage, a pair of arms fulcrumed on said carriage, a fabric-applying member on each of said arms, a weight acting on and common to both of said arms tending to draw said arms toward the core, means to advance said carriage and members toward the core-axis, whereby the members may act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, and manually-operable means adapted to rock said arms on their fulcrums, whereby to modify the action of said weight on said arms, substantially as described.

15. In a tire-machine, the combination of a revoluble tire-core, a carriage, a pair of arms fulcrumed on said carriage, a fabric-applying roller mounted on each of said arms, said rollers being adapted to act simultaneously on opposite sides of the core, means acting on said arms tending to press or force said rollers toward the core, means to advance said carriage and rollers toward the axis of the core, whereby the rollers act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, a right-angle manually-operable lever connected to one of said arms, and a link connecting said lever to the other arm, whereby the operator is enabled to swing said arms on their fulcrums to modify the action of said arm-pressing means, substantially as described.

16. In a tire-machine, the combination of a revoluble tire-core, a carriage, a pair of arms fulcrumed on said carriage, a fabric-applying member on each of said arms, said members being adapted to act simultaneously on both sides of the core, a weight common to and acting on said arms tending to press or force the members toward the core, and manually-controlled means adapted to advance said carriage and members toward the axis of the core at any one of a plurality of speeds, whereby the members act progressively on opposite sides of the core on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, the rate of advance of said carriage being determined in accordance with the contour of the surface to which the ply is being applied, substantially as described.

17. In a tire-machine, the combination of a revoluble tire-core, a carriage movable toward and away from the core, means to move said carriage, means mounted on said carriage and adapted to stretch the fabric as it is applied to the core, a second carriage mounted on said first-named carriage, a pair of fabric-applying members mounted on said second carriage and adapted to act simultaneously on opposite sides of the core, and means to advance said second carriage on the first carriage and members toward the axis of the core, whereby said members act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, substantially as described.

18. In a tire-machine, the combination of

a revoluble tire-core, a carriage, means to actuate said carriage, means mounted on said carriage and adapted to stretch the ply of fabric as it is applied to the core, including a member adapted to travel on the surface of the core or plies already applied thereto, a second carriage mounted on said first-named carriage, a pair of rollers on said second carriage positioned to act simultaneously on opposite sides of the core, means yieldingly pressing said rollers toward the core, and means to advance said second carriage on the first carriage and rollers toward the axis of the core whereby such rollers act on successive portions of the tire-fabric to apply the same to the core or a previously applied underlying ply of fabric on the core, substantially as described.

19. In a tire-machine, the combination of a revoluble tire-core, a carriage a checking-roller mounted on said carriage ... adapted to frictionally engage the surface of the core or fabric plies thereon, a stretching-roller about which the ply of fabric passes to the core, gearing between said stretching and checking-rollers, a second carriage mounted on said first-named carriage, a pair of fabric-applying rollers mounted on said second carriage, means yieldingly pressing said fabric-applying rollers toward the core, said rollers being adapted to act simultaneously on opposite sides of the core, and means to advance said second carriage toward the core to permit said rollers to act progressively on successive portions of the tire-fabric to apply the same to the core or previously applied underlying plies of fabric on the core, substantially as described.

20. In a tire-machine, the combination of a revoluble tire-core, a carriage, a spring-pressed mounting on said carriage, a checking-roller in said mounting adapted to bear against the surface of the core or applied plies thereon, a stretching-roller in said mounting with which the strip of fabric as it is applied to the core co-acts, gearing between said checking and stretching-rollers whereby the latter has a definite movement with respect to the surface on which the checking-roller travels, a second carriage mounted on said first-named carriage, a pair of fabric-applying rollers mounted thereon adapted to act simultaneously on opposite sides of the core, means yieldingly pressing said rollers toward the core, and means to advance said second carriage on the first carriage and its rollers toward the axis of the core at different speeds of travel whereby the rollers act progressively on successive portions of the tire-fabric to apply the same to the core or previously applied underlying plies of fabric on the core, the different speeds of advance of said second carriage and rollers being employed for applying the fabric on different portions of the core and determined by the contour of the surface to which the ply is being applied, substantially as described.

21. In a tire-machine, the combination of a revoluble tire-core, a carriage movable toward the axis of the core, a fabric-applying roller mounted on said carriage and located in a plane oblique to the path of rotation of the core at the point of action of the roller on the core, means to hold the carriage substantially fixedly in position during the application of the fabric on the surface of the tire between the clench and toe of the bead, and means to cause said roller to traverse said surface during such holding of the carriage to apply the fabric thereto, substantially as described.

22. In a tire-machine, the combination of a revoluble tire-core, a fabric-applying roller, a mounting for said roller, a pair of centering-springs on said mounting between which said roller is accommodated, said springs permitting the roller to shift axially in opposite directions from its normal center position to accommodate itself to irregularities of the bead, and means to advance said roller and mounting toward the core axis, whereby the roller may act progressively on successive portions of the tire-fabric to apply the same to the core or previously applied plies, substantially as described.

23. A roller for applying frictioned fabric to a rotating core and smoothing said fabric upon the core, the boundary of the forward working-side or face being rounded off on a curve of short radius and meeting the back-face or side at its outer edge, substantially as described.

24. In a machine of the character described, the combination of a revoluble-core, means to shape a ply of fabric to the core, means for advancing said shaping-means across the core-face including a shaft, a friction drive wheel on the shaft, an actuating shaft adjacent to the friction drive wheel, differential friction rollers actuated by said second-named shaft, and means for forcing either of said rollers against the friction drive wheel, substantially as described.

25. In a machine of the character described, the combination of a revoluble-core, means for shaping a ply of fabric to the core, means for advancing said shaping-means across the core-face including a shaft, a friction drive wheel on the shaft, an actuating shaft adjacent to the friction drive wheel, differential friction rollers actuated by said second-named shaft, means for holding said rollers normally out of contact with said friction drive wheel, and means for forcing either of said rollers against the friction drive wheel, substantially as described.

scribed, the combination of a revoluble-core, means for shaping a ply of fabric to the core, means for advancing said shaping-means across the core-face including a shaft, a friction drive wheel on the shaft, an actuating shaft adjacent to the friction drive wheel, an eccentric bearing for said actuating shaft equipped with an arm and a handle, a friction drive roller on said shaft, a friction drive roller of different size on said arm, and means to drive said latter roller from said actuating shaft, whereby rocking of the eccentric bearing will bring either one of said rollers into driving contact with the friction drive wheel, substantially as described.

27. In a machine of the character described, the combination of a revoluble core, means for shaping a ply of fabric to the core, means for advancing said shaping-means across the core-face including a shaft, a friction drive wheel on said shaft, an actuating shaft adjacent to the friction drive wheel, an eccentric bearing for said actuating-shaft equipped with a handle and an arm, a friction drive roller on said actuating shaft, a second friction drive roller of different size on said arm, means to operate said second roller from said actuating shaft, and means yieldingly holding said eccentric bearing in neutral position with neither of the rollers in contact with the drive-wheel, the parts being so related that by turning the eccentric bearing by its handle either of said rollers may be brought into operative relation to said drive wheel, substantially as described.

28. In a tire machine, the combination of a core, means for rotating the core, a support, a stitcher on the support, power driven mechanism to cause said stitcher to traverse the side of the core and change speed mechanism in said power mechanism.

29. In a tire machine, the combination of a core, means for rotating the core, a support, a pivotal mounting on said support, a stitcher carried on said mounting, power driven mechanism to cause said stitcher to traverse the side of the core and change speed mechanism in said power mechanism.

30. In a tire machine, the combination of a core, means for rotating the core, a support, a pivotal mounting on said support, a stitcher carried on said mounting movable to change the degree of angularity with relation to the tangent at the point of contact with the core, power driven means to cause the stitcher to traverse the side of the core, and change speed mechanism in said power means.

31. In a tire machine, the combination of a core, means for rotating the core, a support, a pivotal mounting on said support, a swinging arm mounted on said mounting, a stitcher carried on said arm, the stitcher during part of its operation being in one position of angularity with relation to the core, means for moving said arm about the pivot to cause the stitcher to assume different angularity with respect to the tangent at the point of contact with the core, and means for causing the stitcher to traverse the side of the core.

32. In a tire machine, the combination of a core, and means for rotating the same, a vertical pivotal mounting, an arm movable on said mounting, a stitcher on the end of said arm, a resilient mounting for said stitcher between the pivot and the end of the arm, and means for causing said stitcher to traverse the side of the core.

33. In a tire machine, a core, a support for the core, a stitching roller, means for rotating the core and means for causing the stitcher to traverse the side of the core, a second support, a pivotally mounted arm on the second support, a mounting on said arm for said stitching roller, means for maintaining said arm in one position during a portion of the stitching operation and for moving the arm about its pivot to change the angle of the stitcher roller with the core.

WILLIAM C. STEVENS.

Witnesses:
E. E. CAVENSHOFF,
E. M. HAHN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Plaintiff's Exhibit No. 14—Moniteur Belge.

2—390.

UNITED STATES OF AMERICA,

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE.

To all to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the Records of this Office of Pages 4454 and 4457, Issue of August 9, 1908, N. 222, of a Publication entitled:-

M O N I T E U R B E L G E,

JOURNAL OFFICIEL,

STATTSBLAD,

1908.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at Washington in the District of Columbia, this 29th day of July in the year of our Lord one thousand nine hundred and twenty and of the Independence of the United States of America the one hundred and forty-fifth.

Acting Commissioner of Patents.

MINISTÈRE DE L'INDUSTRIE ET DU TRAVAIL.

—

DIRECTION DE L'INDUSTRIE.

—

Liste des brevets dont les annuités, échues pendant le mois de septembre 1907, n'ont pas été acquittées dans le délai légal.

—

204e PUBLICATION.

NUMÉRO du brevet.	NOMS DES BREVETÉS.	DATE LÉGALE OU brevet.	ENREGISTREMENT. Bureau de perception.	ENREGISTREMENT. Art. du sommier.	NATURE du brevet.	OBJET DU BREVET.
Province d'Anvers.						
19 751	Van Wigerdt.	21 sept. 1906	Anvers.	52	Ltv.	Overdrukken van gravuren, teekening, plans, enz.
191499	Wauters	1 —	—	30	Inv.	Transmission pour automobiles.
Province de Brabant.						
183354	Alexander	3 sept. 1907.	Bruxelles.	106485	Inv.	Accepteur les chèques.
183801	Aktien Ges. für Schmirgel- und Maschine Fabrikation.	16 —	—	106633	—	Rabattre les roues coniques.
185390	Id.	16 —	—	106636	—	Tuberculeuse à double effet.
179711	Aarts	23 — 1906	—	110135	—	Fabrication du cuir.
194494	Aubry.	7 — 1906	—	129971	—	Guêtres pour chevaux.
194490	Adams	17 —	—	130116	—	Cuvette pour W. C.
194780	Andersen	19 —	—	130141	Imp.	Lampes.
194789	Ahrendt et Cie.	20 —	—	130158	Inv.	Rivetage.
194788	Ado	20 —	—	130160	—	Papiers.
194884	Abeel et Jongiet.	24 —	—	130220	—	Pneu élastique.
194824	Arnoudt.	25 —	—	130228	Imp.	Nettoyage de navires et wagons.
106401	Buchringer C. F. & Sohne . . .	18 — 1895	—	98315	—	Composé d'albumine-ferrugineux.
119015	Babcock et Wilcox Limited . .	26 — 1894.	—	685	Inv.	Générateur de vapeur.
185650	Beard	19 — 1901.	—	106711	—	Support pour prise de courant.
185408	Bridé.	20 —	—	106804	—	Bas perdu.
179529	Bonnet	24 — 1905	—	111109	—	Mélanger les liquides.
178740	Behr	25 —	—	112244	—	Fermeture pour carbonche.
179399	Blackell.	8 — 1904.	—	118038	Imp.	Perforatrices de rochers.
179400	Id.	8 —	—	118039	—	Perforateur de métal.
179674	Brownlow	26 —	—	118230	Inv.	Galons pour fermer les rideaux, etc.
179744	Bosch.	30 —	—	118300	—	Destruction d'insectes.
186634	Brooks et Watson	3 — 1905	—	125795	Imp.	Appareil à photographier.
186738	Bilhorli	11 —	—	125946	Inv.	Un jeu de tour compensateur thermique.
186845	Bader	14 —	—	125917	—	Système pour le vide.
186845	Id.	14 —	—	125918	—	Serre-tuyaux les tuyaux.
186811	Bouvier	14 —	—	125950	—	Armature pour produits céramiques.
186888	Borini.	16 —	—	125981	—	Semelle en bois.
186951	Brandts et Appelberg	20 —	—	126057	—	Production d'or.
187081	Baldwin	23 —	—	126078	—	Verre armé.
187082	Id.	23 —	—	126079	—	Fabrication du verre armé.
194901	Brenier	1 — 1906.	—	129836	—	Détente pour fusils.
194890	Buriart	1 —	—	129839	—	Moteur.
194905	Berthon	1 —	—	129896	—	Support à ressort.
194445	Bardin née Rauh	5 —	—	129948	—	Lunette.
194469	Bailey	6 —	—	129965	—	Joint.
194545	Bonet-Dorna	8 —	—	129993	—	Pneus.
194571	Bolle et Cie, G. m. b. H. . . .	10 —	—	130014	—	Sels pharmaceutiques.
194570	Buris	10 —	—	130015	—	Accouplage.
194596	Blondeau	12 —	—	130054	—	Bouchon.
194637	Bretmacker	13 —	—	130046	—	Roulement.
194615	Backlach	13 —	—	130052	—	Fermeture les extrémités de boudins de cigares.
194638	Bonavita.	13 —	—	130038	—	Pelleteuse continue.
191669	Breiller et Barjau	15 —	—	130035	—	Pompe.

NUMÉRO du brevet.	NOMS DES BREVETÉS.	DATE LÉGALE du brevet.	ENREGISTREMENT. Bureau de perception.	ENREGISTREMENT. Art. du sommier.	NATURE du brevet.	OBJET DU BREVET.
194436	Koepf.	4 sept. 1906	Bruxelles.	129851	Inv.	Sécher la gélatine.
194473	Id.	6 —	—	129909	—	Transporter la gélatine.
194492	Killen.	7 —	—	129901	Imp.	Gonfler les pneus.
194509	Kuppenheim.	10 —	—	130006	Inv.	Assemblement de pièces précieuses.
194649	Kunststeinwerke Zirkus Seydoth Baumann et C.	14 —	—	130071	—	Soupape de rupture.
194695	Koch.	18 —	—	130123	—	Emballage.
194875	Kleuz et Baumont.	28 —	—	130265	—	Suspension pour véhicules.
911853	Lyon.	17 — 1894.	—	62485	—	Harpe.
658596	Lutke.	7 — 1901.	—	101055	—	Emulsions pour papiers au chlorure d'argent.
538643	Linsauer.	9 —	—	101165	—	Gants.
165343	Lint.	4 — 1908.	—	106166	—	Pot à échappement.
165344	Id.	4 —	—	106167	—	Démarrage.
165370	Lesange.	4 —	—	106209	—	Chauffage de l'eau.
165601	Lewicki.	17 —	—	106581	—	Revivification de matières filtrantes.
178598	Libert.	7 — 1905.	—	112 23	—	Joint.
179980	Laupold.	2 — 1906.	—	117950	—	Crochon de chauffage.
186882	Labre.	15 — 1905.	—	123968	—	Réparation de parus.
186880	Lebrun.	16 —	—	1239 8	—	Application de la méthode des disques rotatifs à la technique microscopique.
187097	Langer.	28 —	—	124158	Imp.	Admission dans les foyers fumivores.
194398	Lajoie.	1 — 1906.	—	129011	Inv.	Filtre.
191435	Leyman.	4 —	—	129958	—	Plateau de laptéaire.
194441	Lainé.	5 —	—	129957	—	Abat-jour.
194458	Levy.	5 —	—	129977	—	Tente de plage.
194481	Id.	5 —	—	129958	—	Voiture pliante.
194671	Leeves et Pieper.	6 —	—	129968	—	Brosse.
194699	Loewy et Schifton.	18 —	—	130128	—	Fenêtre.
194800	Lasseran.	24 —	—	130192	—	Arrêt pour poulie.
191806	Lenze.	24 —	—	130904	Imp.	Aéroplane.
194862	Lesparre et Beguin.	27 —	—	130252	Inv.	Bouchon.
194860	Lannoy et C°	27 —	—	130261	—	Buzette.
158728	Matières et Lov. Lic.	14 — 1901.	—	101145	—	Former des billes aux tubes métalliques.
158781	Id.	14 —	—	101146	—	Id.
158814	Mathieu.	27 —	—	101251	—	Roulements à billes.
165359	Moore.	2 — 1902.	—	106183	—	Fendre les peaux.
165497	Maschinenfabrik und Mühlenbauanstalt G. Luther A. G.	9 —	—	106579	—	Support pour crible.
165736	Mc Lenile.	23 —	—	106778	Imp.	Cuire les gaufres.
165748	Maiche.	24 —	—	106788	Inv.	Surchauffeur.
172402	Moes.	7 — 1905.	—	112036	—	Distributeur pour moteurs à gaz.
174750	Mangold.	26 —	—	112299	—	Rolleu à côtes repliables.
179339	Magnin.	7 — 1904.	—	117994	Imp.	Rafraîchir les appartements.
179589	Michaud.	17 —	—	118134	Inv.	Pompe.
179686	Marconi's Wireless Telegraph Company Limited.	24 —	—	118229	—	Transmetteur télégraphique.
186635	Muncke.	2 — 1905.	—	123792	—	Remplir des récipients de substances plastiques.
186649	Morrell.	4 —	—	123816	—	Carburateur.
186750	Mochet.	8 —	—	123867	—	Fixer les fourches des vélos.
186777	Maschinenfabrik Georgswerk, G. m. b. H.	9 —	—	123885	Imp.	Lier les gerbes.
186800	Melsen.	11 —	—	123892	Inv.	Encastrement des rails de tramway.
186837	Mac Bride.	13 —	—	123957	—	Biseauter les glaces.
186839	Manighetti.	15 —	—	123964	—	Chemin de fer portatif.
186885	Markevitch.	16 —	—	123989	—	Traitement de métaux.
186913	Mc Arthur.	18 —	—	124001	Imp.	Réflecteur.
186906	Maes et Drapa.	18 —	—	124003	Inv.	Arrêt pour chaise.
186941	Mann.	20 —	—	124026	Imp.	Tube à mèche.
186954	Mathis.	20 —	—	124035	Inv.	Remplissant d'asphalte.
186954	Meyer et Meunier.	21 —	—	124054	Imp.	Attache-cravate.
187008	Moore.	22 —	—	124062	Inv.	Chasse à siphons pour w. c.
194552	Maggiù.	3 — 1906.	—	129998	—	Suspendre les feuilles de tabac.
194593	Marche.	12 —	—	130029	—	Tubes.
194707	Maier et Remshardt.	18 —	—	130155	—	Moteur.
194731	Maffeyo.	20 —	—	130161	—	Fabriquer les pneus.
194781	Marie.	22 —	—	130182	—	Roue élastique.
194802	Marionnaud.	24 —	—	130200	—	Frein.
194831	Martin.	24 —	—	130217	—	Jante.
194853	Mousset et Thirart.	26 —	—	130228	—	Coupe-papier.
194875	Neckarsulmer Fahrradwerke A. G.	28 —	—	130268	—	Moyeu frein.
194481	Neumann.	7 —	—	129977	—	Réglage de moteurs.
158847	Oswald et Bowman.	25 — 1901.	—	101249	—	Production du gaz.
179313	Olsen et Graies.	16 — 1904.	—	118117	—	Eteindre et rallumer les becs de gaz.
186690	O'Brer.	7 — 1905.	—	123802	—	Lampe à arc.
115047	Pfister, Pactz et Lewis.	19 — 1899.	—	90012	—	Teinture du bois.
145148	Phinon.	13 —	—	90103	Imp.	Bol à barbe.

Plaintiff's Exhibit No. 16—Plaintiff's Forms of License Agreement since January, 1919.

Within the 6th Circuit.

SUPPLEMENTAL AGREEMENT.

WHEREAS, FRANK A. SEIBERLING, of Akron, Ohio, hereinafter referred to as the Lessor, and..... ....., of....., a corporation of the State of....., hereinafter referred to as the Lessee, have been and now are under a lease agreement in respect to Pneumatic-Tire-Shoe Manufacturing Machines, which are the property of said Lessor and in use by said Lessee;

AND WHEREAS, United States Letters Patent No. 941,962, of November 30, 1909, hereinafter referred to as the State patent, covering certain improvements in Pneumatic-Tire-Shoe Manufacturing Machine, embodied in the leased machines hereinbefore referred to, has been declared partially invalid in a decision rendered December 13, 1918, on which judgment was entered February 14, 1919, by the United States Circuit Court of Appeals for the Sixth Circuit in the suit of The Firestone Tire & Rubber Company, defendant and appellant, against Frank A. Seiberling, plaintiff and appellee; and the Lessor states that it is his purpose to litigate the State patent in another circuit or circuits, and if possible and necessary in the Supreme Court of the United States, with the idea of obtaining the revalidation of such claims, for example, in the suit now pending in the third circuit against John E. Thropp's Sons Company, of Trenton, New Jersey;

AND WHEREAS the Lessor, in view of said decision, has proposed to said Lessee either of the following alternative arrangements; first, to accept the immediate return of the aforesaid leased machines, with termination of said lease agreement under its own provisions, or, second, to continue said lease agreement with the certain modified

terms which are hereinbelow set forth and agreed to in full; and the Lessee has elected to accept and agreed to the second of such proposed arrangements:

NOW, THEREFORE, in consideration of the premises and of the modified terms hereinbelow mutually agreed to and of One Dollar by each party unto the other paid, receipt of which is hereby acknowledged, the said Lessor and Lessee have agreed and do hereby formally covenant and agree as follows:

(1) It is hereby agreed that the Lessee is to have the right to retain the leased machines referred to or covered by said lease agreement, and may continue to operate the same.

(2) It is further agreed that the Lessee will keep accurate account of the rentals accruing through its use of the machines, in the manner provided for in said lease agreement, and will continue to report the full amount of these accruing rentals to the Lessor monthly, as heretofore.

(3) It is further agreed that the Lessee will pay to the Lessor for each month commencing January 1, 1919 an amount equal to one-half of such accrued and reported rentals; and that the Lessee may retain the remaining half of such rentals for the present.

(4) If the Circuit Court of Appeals for the Third Circuit fails to revalidate substantial claims of the State patent, it is further agreed that further payment by the Lessee to the Lessor of rentals shall be discontinued and the machine shall become the property of the Lessee without further consideration.

(5) If, however, the Circuit Court of Appeals for the Third Circuit does revalidate substantial claims of the State patent, it is agreed that the Lessee shall continue paying the Lessor one-half of the accruing rentals as provided in Clause (3) above, pending such review as the Supreme Court of the United States may grant upon any application for writ of *certiorari* or otherwise.

(6) If the Supreme Court of the United States thereafter revalidates substantial claims of the State patent, it is agreed that thereupon the Lessee shall immediately pay to the Lessor all the retained rentals provided in Clause (3), with interest at 6% per annum, and that the lease agreement is thereupon to be reinstated automatically in all its original terms.

(7) If, however, the Supreme Court of the United States fails to revalidate substantial claims of the State patent, it is agreed that the lease agreement shall thereupon automatically become null and void, and that the machines shall become the property of the Lessee without further consideration and without further rental payments; and it is understood that the steps and procedure intended to secure such review by the Supreme Court shall be taken by the Lessor with all reasonable diligence.

IN WITNESS WHEREOF the parties have hereunto affixed their signatures and seals this.....day of.....1919.

.....
Lessor

Witnesses:

.....

.....

.....
Lessee

Attest:

.....
Secretary

By.....
President

Outside of the 6th Circuit.

SUPPLEMENTAL AGREEMENT

WHEREAS, FRANK A. SEIBERLING, of Akron, Ohio, hereinafter referred to as the Lessor, and the .... of ....., a corporation of the state of ....., hereinafter referred to as the Lessee, have been and now are under a lease agreement in respect to Pneumatic-Tire-Shoe Manufacturing Machines, which are the property of said Lessor and in use by said Lessee;

AND WHEREAS, United States Letters Patent No. 941,962, of November 30, 1909, hereinafter referred to as the State patent, covering certain improvements in Pneumatic-Tire-Shoe Manufacturing Machines, embodied in the leased machines hereinbefore referred to, has been declared partially invalid in a decision rendered December 13, 1918, on which judgment was entered February 14, 1919, by the United States Circuit Court of Appeals for the Sixth Circuit in the suit of The Firestone Tire & Rubber Company, defendant and appellant, against Frank A. Seiberling, plaintiff and appellee; and the Lessor states that it is his purpose to litigate the State patent in another circuit or circuits, and if possible and necessary in the Supreme Court of the United States, with the idea of obtaining the revalidation of such claims, for example, in the suit now pending in the third circuit against John E. Thropp's Sons Company, of Trenton, New Jersey;

AND WHEREAS, the Lessor, in view of said decision, has proposed to said Lessee either of the following alternative arrangements; first, to accept the immediate return of the aforesaid leased machines, with termination of said lease agreement under its own provisions, or, second, to continue said lease agreement with the certain modified terms which are hereinbelow set forth and agreed to in

full; and the Lessee has elected to accept and agreed to the second of such proposed arrangements:

NOW, THEREFORE, in consideration of the premises and of the modified terms hereinbelow mutually agreed to and of One Dollar by each party unto the other paid, receipt of which is hereby acknowledged, the said Lessor and Lessee have agreed and do hereby formally covenant and agree as follows:

(1) It is hereby agreed that the Lessee is to have the right to retain the leased machines referred to or covered by said lease agreement, and may continue to operate the same.

(2) It is further agreed that the Lessee will keep accurate account of the rentals accruing through its use of the machines, in the manner provided for in said lease agreement, and will continue to report the full amount of these accruing rentals to the Lessor monthly, as heretofore.

(3) It is further agreed that the Lessee will pay to the Lessor for each month commencing January 1, 1919 an amount equal to one-half of such accrued and reported rentals; and that the Lessee may retain the remaining half of such rentals for the present.

(4) In case the Circuit Court of Appeals for the Third Circuit denies the validity of all substantial claims of the State patent, it is agreed that all further payments of rentals by the Lessee may be discontinued, and that the leased machines shall become the property of the Lessee without further consideration.

(5) If, however, the Circuit Court of Appeals for the Third Circuit revalidates substantial claims of the State patent, it is hereby further agreed that upon the rendering of such decision, the Lessee will pay to the Lessor with interest at 6% per annum the accrued amount representing the withheld one-half of the rentals referred to in Clause (3) above, and that the lease agreement is then

to be forthwith reinstated automatically in all its original terms.

(6) If, thereafter, however, the Supreme Court of the United States should ultimately invalidate all substantial claims of the State patent, it is further agreed that the lease agreement shall then automatically become null and void, and the leased machines become the property of the Lessee without further consideration and without further rental payments.

IN WITNESS WHEREOF the parties have hereunto affixed their signatures and seals this ..... day of ....., 19...

.....
Lessor

Witnesses:

.....

.....

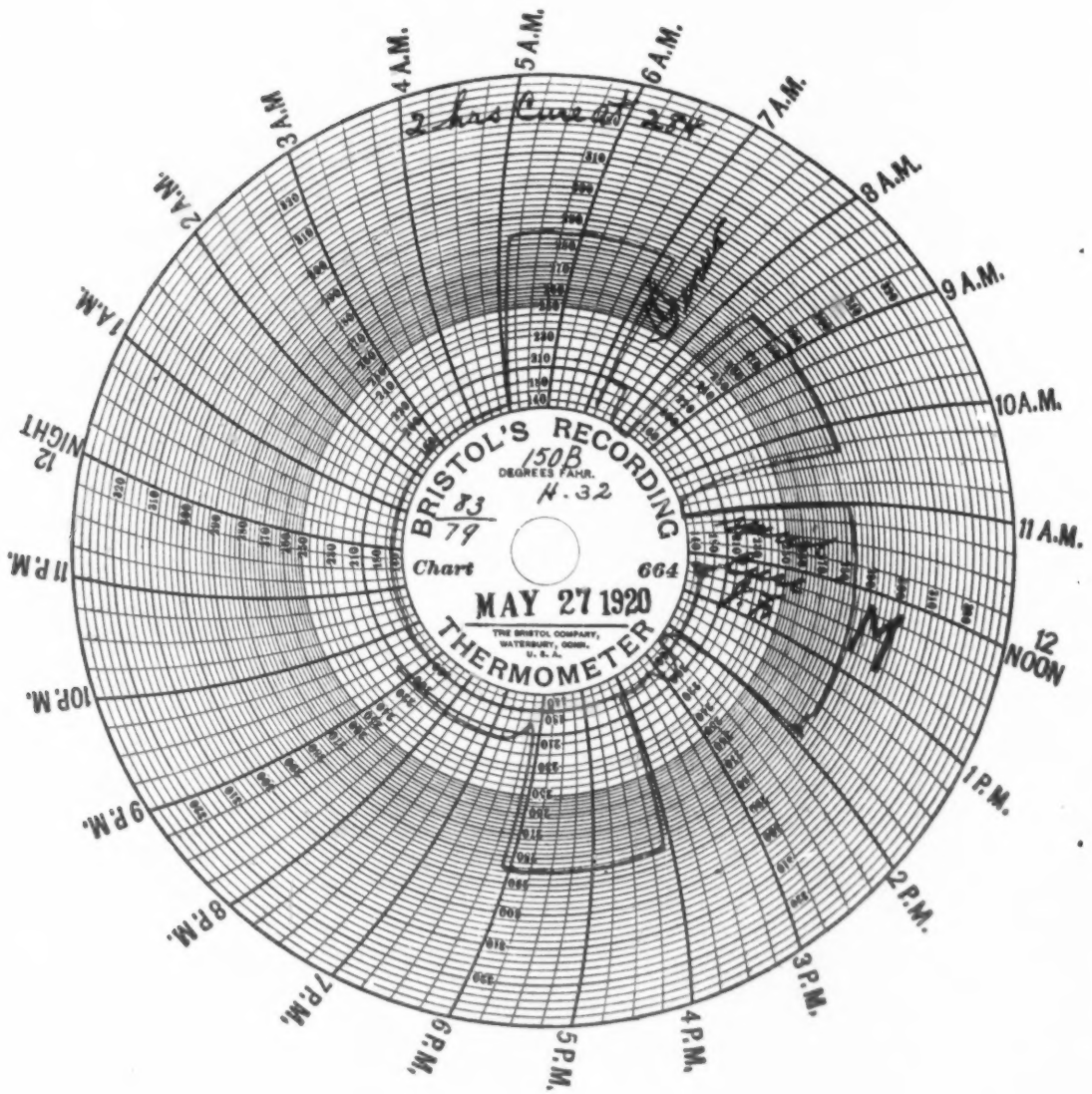
.....
Lessee

By .....
President

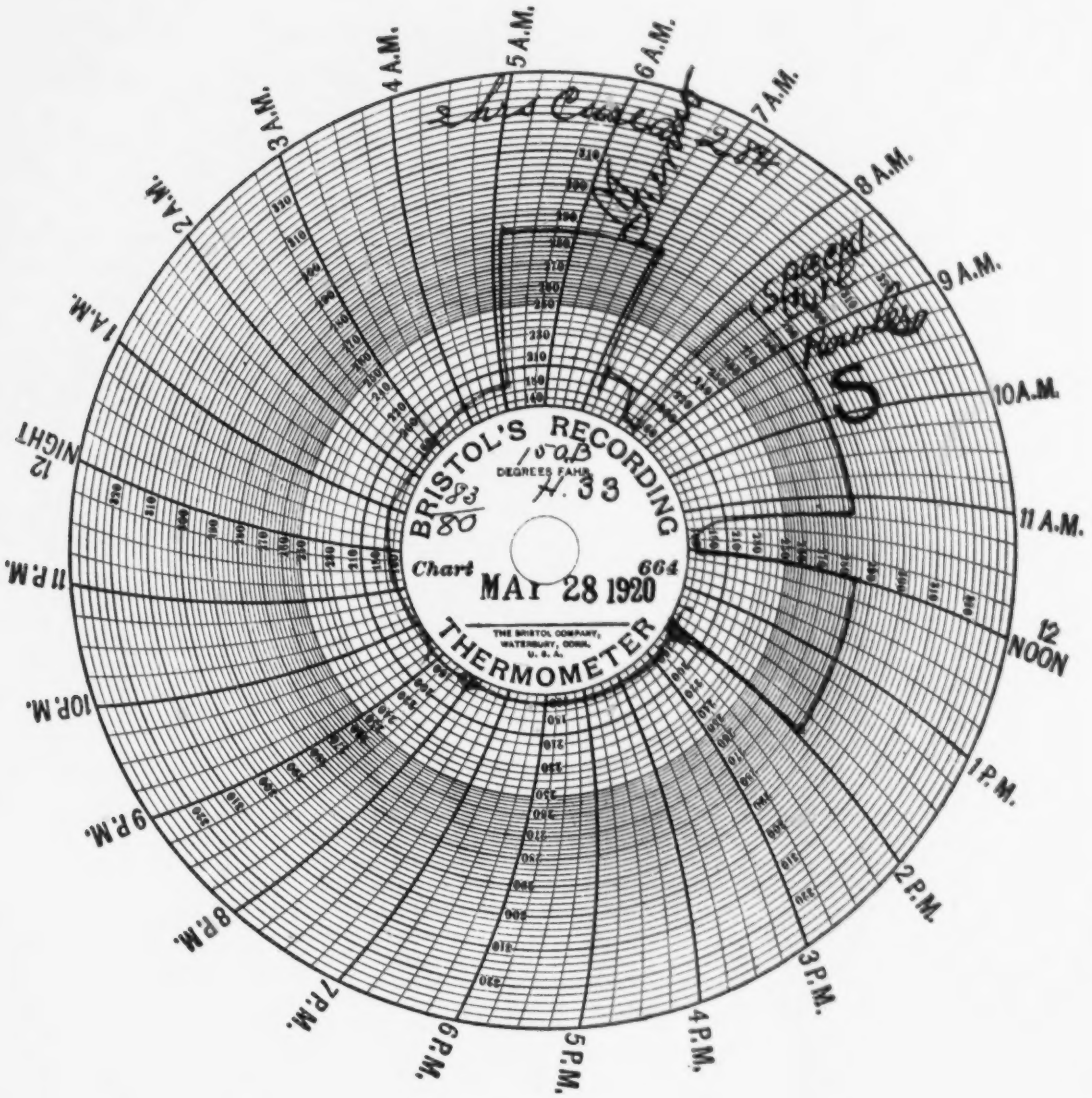
Attest:

.....
Secretary

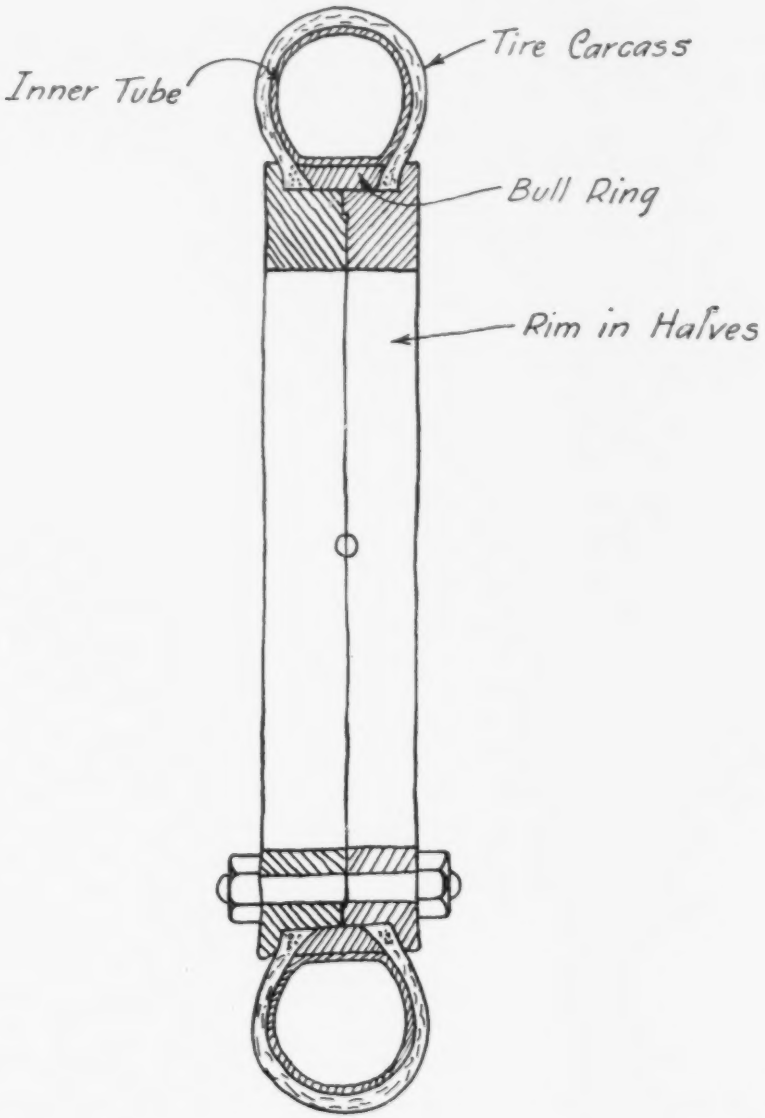
Plaintiff's Exhibit No. 17—Vulcanizing Charts.
(Mackey Tires.)



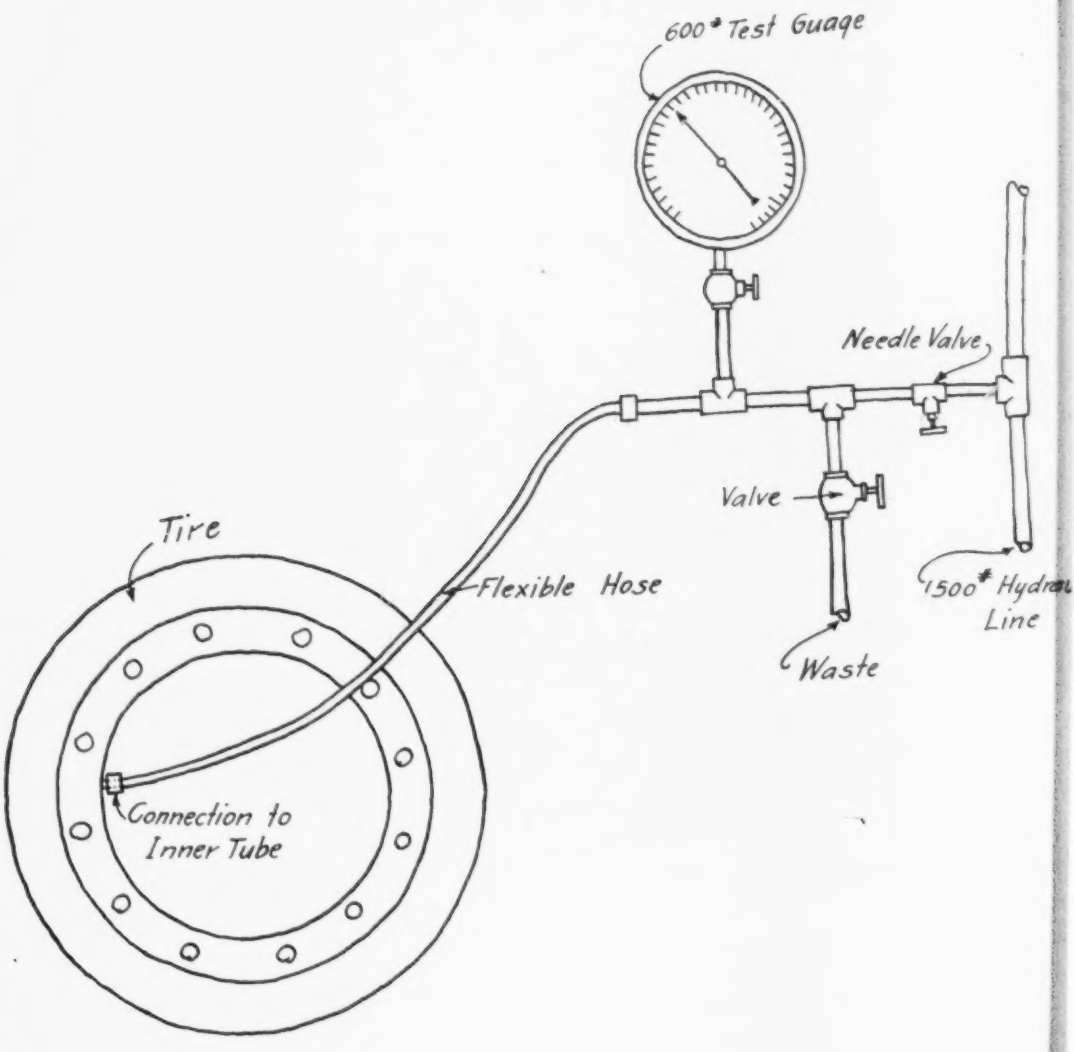
Plaintiff's Exhibit No. 17—Vulcanizing Charts.
(Shaw Tires.)



Plaintiff's Exhibit No. 20—Ray Holding Device.



Plaintiff's Exhibit No. 21—Ray Bursting Apparatus.



Plaintiff's Exhibit No. 22—Pages 163 and 164, American Machinist Gear Book.

(Page 163.)

SECTION VI

Worm Gears

An interesting model of half a dozen sets of worm gears is shown in Fig. 109. All the gears are of the same diameter with teeth of the same normal pitch, though the respective speed ratios of the various sets differ. The horizontal shaft in making 32 revolutions causes the vertical gear in the fore-

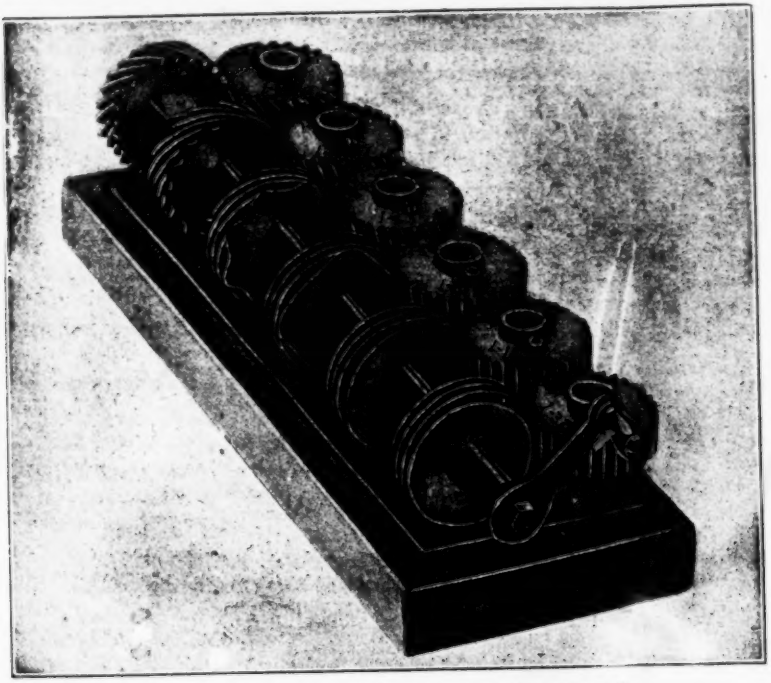


FIG. 109. MODEL OF SPIRAL GEARS OF VARIOUS RATIOS.

ground to make but one complete revolution, the second, two complete turns, and each of the succeeding vertical gears twice the number of revolutions made by the gear immediately in front of it, the furthermost gear making 32

Plaintiff's Exhibit No. 22—Pages 163 and 164, American Machinist Gear Book.

(Page 164.)

revolutions to 32 turns of the horizontal shaft. The consecutive speed ratios, commencing with the set in the foreground, are respectively 32:1, 16:1, 8:1, 4:1, 2:1 and 1:1, the revolutions of the horizontal shaft being named first.

The first three drives are evidently worms of single, double and quadruple thread respectively, but they are also spiral gears as the driven gears are cut with spiral teeth, not simply hobbed as is customary in laying out worm gears. The balance of the drivers resemble spiral gears even more, particularly the most remote, showing that the so-called "worm" is in reality a toothed gear of the spiral type.

NOTATION FOR WORM GEARS

N = number of teeth in worm wheel.
n = number of threads in worm.
p' = circular pitch (distance from center to center of teeth).
L = lead (advance of worm in one revolution).
D' = pitch diameter of worm wheel.
T = throat diameter of worm wheel.
D = outside diameter of worm wheel.
F = face of worm wheel.
a = distance from center line to point of tooth.
b = length of side.
d' = pitch diameter of worm.
d = outside diameter of worm.
d'' = bottom diameter of worm.
e = radius at throat of worm wheel.
ϕ = angle of sides of face.
B = center distance.
R = number of revolutions of worm to one of wheel.
δ = angle of teeth in wheel with axis (used for gashing teeth).
π = 3.1416.
W = working depth.
W' = whole depth.
f = clearance.
t = thickness of tooth at pitch line.
t' = normal thickness of tooth at pitch line.
p'_n = normal circular pitch.
s = addendum.
U = width of worm thread at top.
Y = width of worm thread at bottom.
p = diametral pitch.

Plaintiff's Exhibit No. 23—Pages 102, 106, 107, The Theory of Machines.

(Page 102.)

same in each gear. Calling the normal pitch p, then for both gears $p = p_1 \cos \theta_1 = p_2 \cos \theta_2 = 1.256 \cos 26° 34' = 1.123$ in.

For the gear G the number of teeth $t_2 = 40$ since $n_1 = 2n_2$ and $p_1 = 2.513$ in. while $p = 1.123$ in. A sketch of the gear F is given at Fig. 62.

117. Form of Teeth.—Much discussion has arisen over the correct form of the teeth on such gears, and indeed it is almost impossible to make a tooth which will be theoretically correct, but here again one is to be guided by the fact the correct conditions must be fulfilled in the plane normal to the line of contact. Hence on this normal plane the teeth should have the correct involute or cycloidal profile.

In this type of gearing there is a good deal of slip along the line of contact (CQ) resulting in considerable frictional loss and wear, but such gearing, if well made will run very smoothly and quietly. Although it is difficult to construct there are cases where the positions of the shafts make its use imperative.

SPIRAL OR SCREW GEARING

The Teeth of which have Point Contact

118. Screw Gearing.—In speaking of gears for shafts which were not parallel and did not interest two classes were mentioned: (a) hyperboloidal gears, and (b) spiral or screw gears and this latter class will now be discussed, the former having just been dealt with. In screw gearing there is no necessary relation between the diameters of the wheels and the velocity ratio n_1/n_2 between the shafts; thus it is frequently found that while the camshaft of a gas engine runs at half the speed of the crankshaft, the two screw gears producing the drive are of the same diameters, while if skew level gears were used the ratio of diameters would be 1 to 4 (Sec. 114(d)) and bevel and spur gears for the same work would have a ratio 1 to 2.

119. Worm Gearing.—The most familiar form of this gearing is the well-known worm and worm wheel which is sketched in Fig. 63, and it is to be noticed that the one wheel takes the form of a screw, this wheel being distinguished by the name of the **worm.** The distance which any point on the pitch circle of the worm wheel is moved by one revolution of the worm is called the axial pitch of the worm, and if this pitch corresponds to the distance from thread to thread along the worm parallel to its

Plaintiff's Exhibit No. 23—Pages 102, 106, 107, The Theory of Machines.

(Page 106.)

tion of the worm thread is shown at Fig. 66 in which the proportions used by Brown and Sharpe are the same as in a rack

123. Large Ratio in this Gearing.—Although the frictional losses in screw gearing are large, even when the worm works immersed in oil, yet there are great advantages in being able to obtain high velocity ratios without excessively large wheels. Thus if a worm wheel has 40 teeth, and is geared with a single-threaded worm, the velocity ratio will be $\frac{1}{40}$, while with a double-threaded worm it will be $\frac{2}{40} = \frac{1}{20}$, so that it is very convenient for large ratios. It also finds favor because ordinarily it cannot be reversed, that is, the worm must always be used as the driver and cannot be driven by the wheel unless the angle θ is large. In cream separators, the wheel is made to drive the worm.

124. Screw Gearing.—Consider now the case of the worm and wheel shown in Fig. 65, in which both are cylinders, and suppose that with a worm of given size a change is made from a single to double thread, at the same time keeping the threads of the same size. The result will be that there will be an increase in the angle θ and hence the threads will run around the worm and the teeth will run across the wheel at greater angle than before. If the pitch be further increased there is a further increase in θ and this may be made as great as 45°, or even greater, and if at the same time the axial length of the worm be somewhat decreased, the threads will not run around the worm completely, but will run off the ends just in the same way as the teeth of wheels do.

By the method just described the diameter of the worm is unaltered, and yet the velocity ratio is gradually approaching unity, since the pitch is increasing, so that keeping to a given diameter of worm and wheel, the velocity ratio may be varied in any way whatever, or the velocity ratio is independent of the diameters of the worm and wheel. When the pitch of the worm is increased and its length made quite short it changes its appearance from what it originally had and takes the form of a gear wheel with teeth running in helices across the face. A photograph of a pair of these wheels used for driving the camshaft of a gas engine is shown in Fig. 67, and in this case the wheels give a velocity ratio of 2 to 1 between two shafts which do not intersect, but have an angle of 90° between planes passing through their axes. This

Plaintiff's Exhibit No. 23—Pages 102, 106, 107, The Theory of Machines.

(Page 107.)

form of gear is very extensively used for such purposes as aforesaid, giving quiet steady running, but, of course, the frictional loss is quite high.

Some of the points mentioned may be made clearer by an illustration. Let it be required to design a pair of gears of this type to drive the camshaft of a gas engine from the crankshaft, the velocity ratio in this case being 1 to 2, and let both gears be of the same diameter, the distance between centers being 12 in. From the data given the pitch diameter of each wheel will be



FIG. 67.—Screw gears.

12 in. and since for one revolution of the camshaft the crankshaft must turn twice, the pitch of the thread on the worm must be $\frac{1}{2} \times \pi \times 12 = 18.85$ in. For the gear on the crankshaft (corresponding to the worm) the "teeth" will run across its face at an angle given by $\tan \theta = \frac{18.85}{\pi \times 12} = 0.5$, or $\theta = 26° 34'$, and this angle is to be measured between the thread or tooth and the plane normal to the axis of rotation of the worm (see Fig. 64). The angle of the teeth of the gear on the camshaft (corresponding to

Plaintiff's Exhibit No. 24—Pages 261 and 262, Pure Mechanism.

(Page 261.)

CHAPTER XII

HELICAL GEARS

265. Classification.—The gears which are to be discussed in this chapter have been variously designated by different authors

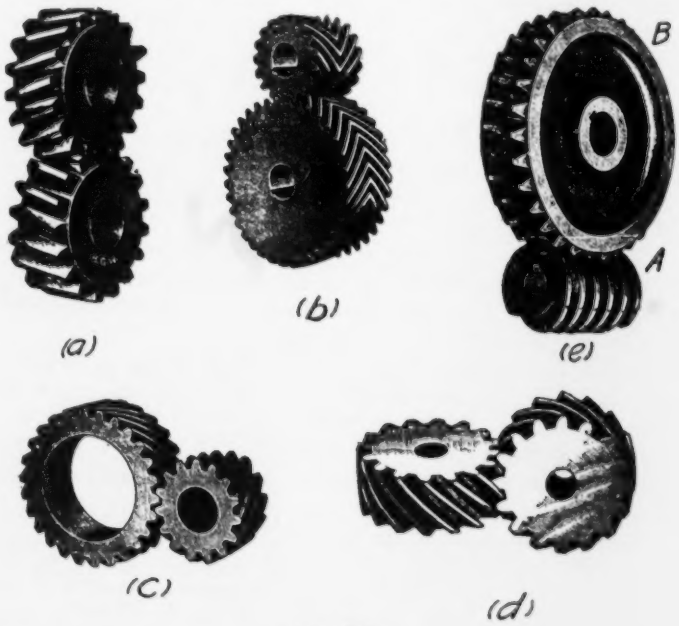


FIG. 254.

as spiral gears, helical gears, screw gears and twisted gears. These names are often confused or used synonymously

The following classification is based on the discussion by Professor MacCord.

Plaintiff's Exhibit No. 24—Pages 261 and 262, Pure Mechanism.

(Page 262.)

Helical or spiral gears	Twisted gears	Single twisted gears, Fig. 254 (*a*).
		Double twisted or herring-bone gears, Fig. 254 (*b*).
	Screw gears	Worm gears, Fig. 254 (*e*).
		The type commonly called spiral gears, Figs. 254 (*c*) and (*d*).

The name *spiral gear*, which was used by Hooke to designate the twisted helical gear, is in a sense erroneous. The geometrical spiral, which is a plane curve, does not enter into its construction. *Spiral* is used rather in the loose sense of a "spiral screw thread" or a "spiral staircase." The tooth elements are in fact portions of a helix.

The slope of the helical tooth elements may be either right or left hand. A right-hand tooth, when viewed from the end of the pitch cylinder, slopes upward to the right and a left-hand tooth slopes upward to the left.

The outlines of the teeth, on the plane of reference, are of the involute form as a matter of convenience but not of necessity, any of the tooth forms that are suitable for spur gears can be used for helical gears.

Helical gears are much used when a great change in velocity is required and where noiselessness and smoothness of action at high speeds are of prime importance.

266. Relation of Axes.—The helical angle is the angle made by the tooth helix with a line parallel to the axis of the gear (α, Fig. 255).

Three arrangements of the axes are to be noted:

(1) Axes parallel.

(2) Axes askew.

(3) Axes at right angles.

Fig. 255, (*a*) and (*b*) illustrate the first arrangement. At (*a*) the helical angles are equal and one is a right-hand helix and the other left. This corresponds to the single twisted gear of Fig. 254 (*a*).

At (*b*), each gear has a right- and a left-hand helix which meet on the median planes of the wheels. This is the double twisted, or herringbone gear, shown in Fig. 254 (*b*).

In Fig. 256 (*a*) and (*b*), the axes are askew and the helical angles are unequal. At (*a*), one of the angles is right hand and the other

mold calls for nearly 140 cubic feet of molten iron the stream is soon exhausted. Before the ladle is quite empty the second one has begun to deliver its contents, the principal item of instruction to the man in charge of it being to keep the runner full. This ladle empties apparently nearly as rapidly as the other, and when its contents have nearly all disappeared the spectator indulges in a moment of anxiety as to the sufficiency of the supply of metal; but it begins to flow from the risers just as the ladle is emptied, and the nice calculation as to the quantity required is vindicated.

The weight of this wheel was of course no test of the capacity of the foundry to produce heavy castings. The only visible limit would be in the ability of the railroads to transport the castings after they were made. The cranes in this case handled the entire charge of metal in the two ladles with perfect ease. For still larger castings standing ladles at a sufficient elevation, with gates and suitable leaders to the mold, could of course be employed. The pouring of a larger wheel, or of similar heavy castings, being a familiar and every-day occurrence at this foundry it did not interfere with the routine work going on in other parts of the floor. Not far from the wheel was a large low-pressure cylinder poured two or three days before and not yet fully uncovered. A little further on they were laying up a loam mold of another cylinder. The pouring of castings of various weights for electrical and other service was also going on. The foundry makes both the heaviest and the lightest castings that customers can call for, and anything between. Their advertised range of "from 40 tons to a quarter of an ounce," or 5,120,000 to 1, is easily within their limit. There were on the floor at the west end, as near as I could calculate, and as I was also told, about 9,000 molds of small work, all put up that day and mostly made in snap flasks, and the molders were pouring them with hand ladles. The patterns for this work were in cards, and some were so small as to have three of these cards to a snap flask. I saw one man pour twelve of these molds, with three separate sprues to each, with one ladleful of iron. R.

▲ ▲ ▲

Progress in Gun Making.

On testing the 8-inch Haskell multicharge gun in February last, by the Board of Ordnance and Fortification of the War Department, only two rounds were fired, and at the second round the metal between the forward pocket and the bore was found to have been crushed in; this rendered the gun unserviceable. The Board has declined to make a recommendation for any further expenditure on multicharge guns, believing, as it does, that smokeless powder has in a great measure obviated the necessity for the multicharge gun

The 8-inch Gatling gun provided for by the Act of June 6, 1896, is now under process of construction.

The mill for hot rolling the segments to be used in the manufacture of a 10-inch Brown segmental tube, wire-wound gun, also the machine for winding wire on the gun with the requisite initial tension, are completed, and the wire and steel for the segments have been made. The lining tube is now in course of construction at the works of the Bethlehem Iron Works. It is expected that the gun will be ready for test about July 1, 1898.

The Bethlehem Iron Company is also making excellent progress on its 100 gun contract of recent date, and it is expected that these guns, consisting of twenty-five 8-inch, fifty 10-inch and twenty-five 12-inch guns, will be completed and delivered considerably in advance of the contract time.

▲ ▲ ▲

Modern Practice with Worm Gearing.

BY F. A. HALSEY.

Several references have of late appeared in these columns to the fact that, in the face of the good results now being obtained, the old prejudice against worm gearing, on account of its supposed low efficiency and short life, is dying out. These good results are the outcome of the application of principles which are by no means a late discovery, and it is expected that the following article will contain much that to some of the readers of this paper is not new. At the same time it is an undoubted fact that the best practice with worms is understood by but few, relatively speaking, and some of the illustrations to follow are believed to be new. No better illustration of the fact that good practice with worm gearing is not yet widely understood could be given than the statement in a recent and excellent work on gearing that "the diameter of the worm is commonly made equal to four or five times the circular pitch," the fact being that such proportions are distinctly bad if hard work is to be done.

It should be stated at the beginning that while the following article is not offered as a presentation of all the data necessary for assured success with worms under all conditions, it is hoped in it to make the general conditions of successful practice plain, and to present the "state of the art" as it exists to-day.

The essential change in practice which has improved the results obtained with worm gearing has been an increase in the pitch over what was formerly considered proper. There is no doubt whatever that this change has increased the efficiency of the gear, and, what is of more importance, has reduced the tendency to heat and rapid wear. This is not only a fact, but it is a sound conclusion from theoretical considerations, which might have been predicted under proper examination.

THEORY OF WORM EFFICIENCY.

The reason why an increase of pitch, other things being equal, or in other words, an increase of the angle of the thread, gives these results, will be understood from Fig. 1. If *a b* be the axis of the worm and *c d* a line representing a thread, against which a tooth of the wheel bears, it will be seen that if the tooth bears upon the thread by a presure, *P*, that pressure may be resolved into two components, one of which, *e f*, is perpendicular, while the other, *e g*, is parallel to the thread surface. The perpendicular

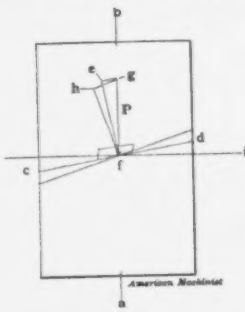


Fig. 1.

THE PRINCIPLE OF WORM EFFICIENCY.

component produces friction between the tooth and the thread. The useful work done during a revolution of the thread is the product of the load *P* and the pitch of the worm, while the work lost in friction is the product of the perpendicular pressure *e f*, the coefficient of friction and the distance traversed in a revolution, which is the length of one turn of the thread. Now, if the angle of the thread be doubled, as indicated, the load *P* remaining the same, the new perpendicular component *f h* of *P* will be slightly reduced from the old valve *e f*, while the length of a turn of the thread will be slightly increased. Consequently their product and the lost work of friction per revolution will not be much changed. The useful work per revolution will, however, be doubled, because, the pitch being doubled, the distance traveled by *P* in one revolution will be doubled. The ratio of the lost work to the useful work is therefore reduced by the increase in the thread angle, and since the tendency to heat and wear is the immediate result of the lost work, it follows that that tendency is reduced. For small angles of thread the change is very rapid ,and continues, though in diminishing degree, until the angle reaches a value not far from 45 degrees, when the conditions change and the lost work increases faster than the useful work, an increase of the angle of the thread beyond that point reducing the efficiency.

This general consideration of the sub-

ject shows the principles at the bottom of successful worm design, but a more exact examination is desirable. According to Professor Barr the efficiency of a worm gear, the friction of the step being neglected, is:

$$e = \frac{\tan a\ (1 - f \tan a)}{\tan a + f}$$

.n which,

e = efficiency

a = angle of thread being the angle d f i of Fig. 1

f = coefficient of friction.

To study the effect of the step, a convenient assumption is that the mean friction radius of the step is equal to that of the worm. This asumption would only be realized in cases where the step is a collar bearing outside the worm shaft, and the preceding and following formulas therefore represent extreme cases, one of a frictionless step, which would be approximated by a ball bearing, and the other of a step having about the extreme friction to be met with. Most actual cases would therefore fall between the two. Again, according to Professor Barr, the efficiency of a worm and step on the above assumption is: *

$$e = \frac{\tan a\ (1 - f \tan a)}{\tan a + 2f} \text{ approximately}$$

Notation as before.

* The derivation of these formulas is somewhat involved and need not be given here. It should, however, be stated that they assume the thread of the worm to be square. Thread profiles in common use affect the results but little.

These formulas give no clear indication of the manner in which the efficiency varies with the angle, and the diagram, Fig. 2, has been constructed to show this to the eye. The scale at the bottom gives the angles of the thread from 0 to 90 degrees, while the vertical scale gives the calculated efficiencies, the values of which have been obtained from the equations and plotted on the diagram. The upper curve is from the first equation, and gives the efficiencies of the worm thread only; while the lower curve, from the second equation, gives the combined efficiency of the worm and step. In the calculation for the diagram it is necessary to assume a value for f, and this has been taken at .05, which is probably a fair mean value. The experiments made by Mr. Wilfred Lewis for Wm. Sellers & Co. showed an increase of efficiency with the speed. The present diagram may be considered as confined to a single speed, and at the same time is not to be understood as showing the exact efficiency to be expected from worms, but rather to exhibit to the eye the general law connecting the angle of the thread with the efficiency.

The curves will be seen to rise to a maximum and then to drop. The exact values of the angle of thread to give maximum efficiency may be easily found by the methods of the calculus, the results being:

For worm thread alone the efficiency is at a maximum when

$$\tan a = \sqrt{1 + f^2} - f$$

Substituting the value of f used in calculating the diagram —.05— this becomes

tan × per maximum efficiency = .9512,

and by referring to a table of natural tangents we find that,

a for maximum efficiency = 43° 34′

Similarly for the worm and step the result is,

tan a for maximum efficiency $= \sqrt{2 + 4f^2} - 2f$ which for $f = .05$ $= 1.318$

and a table of tangents tells us again that

a for maximum efficiency = 52° 49′

Of more importance than the angle of maximum efficiency is the general character of the curves, of which the most pronounced peculiarity is the extreme flatness, showing that for a wide range of angles the efficiency varies but little. Thus, for the upper curve there is scarcely any choice between 30 and 60 degrees of angle, and but little drop at 20 degrees.

At first sight the lower curve might be thought the most useful of the two, as it includes the effect of the step, but a little consideration will show that this is not the case. For most cases in which worms are used the efficiency of the transmission, as such, is of very little account. What the designer concerns himself with is the question of durability and satisfactory working, and the results to be expected in this respect are best shown by the upper curve, in which high efficiency means a durable worm. Throughout this article, in fact, the chief significance of efficiency

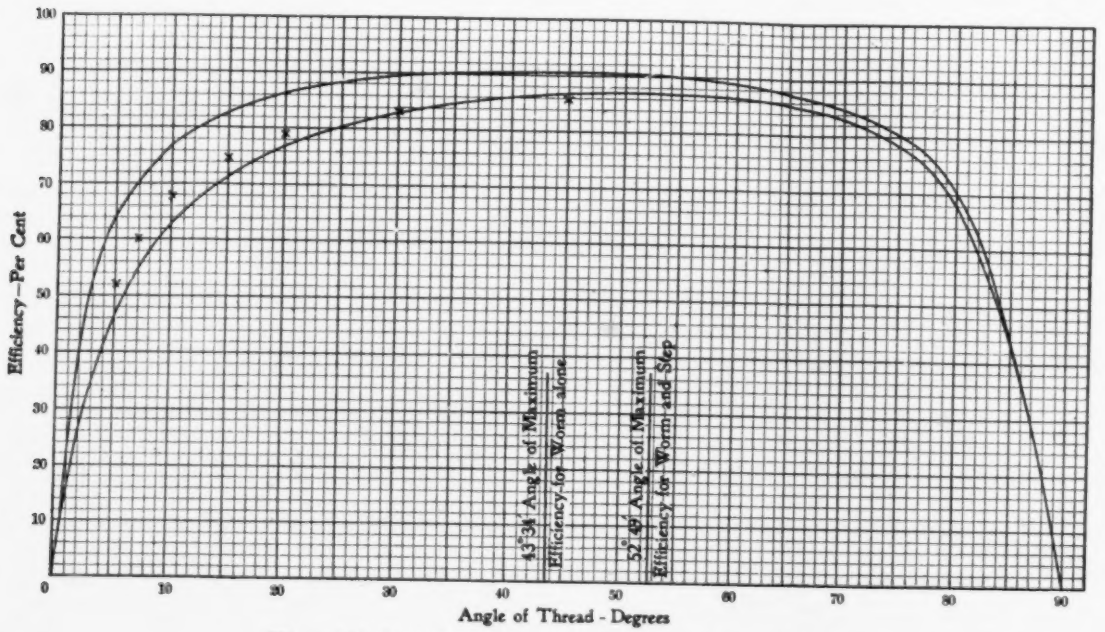


FIG. 2.—RELATION BETWEEN THREAD ANGLE AND EFFICIENCY.

lies in the fact that low efficiency means rapid wear, and vice versa.

EXPERIMENTAL CORROBORATION OF THE THEORY.

The experiments of Wm. Sellers & Co., before referred to, go far to confirm the soundness of the above views. From the present standpoint it is unfortunate that those experiments did not cover a wider range of worm thread angles—those actually used being 5 degrees, 7 degrees and 10 degrees. Other experiments were, however, made on spiral pinions of higher angles, spiral pinions being understood by Mr. Lewis to mean those pinions having the mating gear a true spur, the pinion shaft being at a suitable angle with the gear shaft to bring the pinion in proper mesh—a construction which is exemplified in the well-known Sellers planer drive. Mr. Lewis gives a formula by which the efficiencies of worms can be calculated from those for spiral pinions, and in the absence of direct experiments on worms of high angles, his results for spiral pinions have been modified by this formula to read for worms. The results for the two forms of gearing differ by less than 5 per cent. for the extreme case of his experiments. To compare the results obtained by Mr. Lewis with Professor Barr's formula, a speed has been selected from the experiments giving the nearest coefficient of friction to that used in obtaining the curves of Fig. 2. The results have been plotted in Fig. 2, where they appear as small crosses, and will be seen to have a very satisfactory agreement with the lower curve, with which they should be compared, as the steps of the worms used by Mr. Lewis were of the usual pattern without balls.

The variation of the coefficient of friction with the speed lends an interest to Fig. 3, which is a series of curves obtained from the results published by Mr. Lewis in the same manner as the crosses of Fig. 2, the curve for 20 feet velocity being in fact the same as that appearing as crosses in Fig. 2. The other curves of Fig. 3 are obtained from those of Mr. Lewis, and cover a range of velocities from 3 to 200 feet per minute at the pitch line, as noted at the right. In this diagram the results obtained by Mr. Lewis on worms are plotted direct, but the experiments on spiral pinions have been modified as explained above. Inspection of the curves shows that while there is a progressive increase of efficiency with the speed, there is, nevertheless, not much probability, or indeed room, for further improvement beyond the speed of 200 feet per minute. It will furthermore be seen that the efficiency drops off much less for low angles of thread at high speeds than at low.

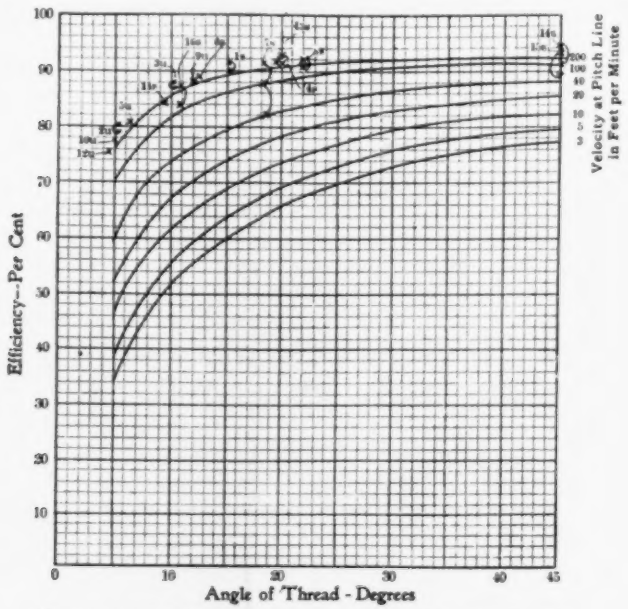


FIG. 3.—RELATION BETWEEN THREAD ANGLE, SPEED AND EFFICIENCY, WITH CASES FROM PRACTICE.

In interpreting this diagram, it should be remembered that the durability of a worm depends upon the amount of power lost in wear, and not upon the percentage so lost. The ability of a given worm to absorb and carry off the heat due to friction is fixed, and does not vary with the speed. That is, a given worm running at 100 revolutions under a given pressure can cary off as much friction heat as the same worm at 200 revolutions, while it, under the same pressure, would transmit but one-half the power in the former case that it would in the latter. In other words, the percentage of lost work might be twice as much at the lower speed as at the higher without increasing the tendency to heat.

The increase of efficiency with the speed is a valuable property of worms, and enables them to do much more work than they otherwise would. Thus the 20 degree worm at 20 feet per minute lost 21½ per cent. of the work in friction. Increasing the speed to 40 feet doubled the work applied, and, had the efficiency remained constant, would have doubled the friction heat to be dissipated. In point of fact, this increase of speed diminished the percentage of loss to 17, and the amount of loss and heat, instead of being doubled, was only increased in the ratio of 160 to 100. It is plain from the diagram, however, that this action does not continue much beyond a velocity of 200 feet per minute, beyond which the amount of loss must be more nearly proportional to the speed, and this doubtless has some connection with the fact observed by Mr. Lewis that 300 feet per minute is the limit of speed when the gears are loaded to their working strength, and that the best conditions are obtained at about 200 feet per minute. It is proper to add, however, that in the cases from practice given later there are three which have been made repeatedly, and which are conspicuously successful, in which the velocity exceeds 600 feet, and one in which it exceeds 800 feet. No doubt, in all such cases, if the pressure on the teeth could be known it would be found to be light.

It will be seen that an increase of speed for any worm under constant pressure leads to an increase of friction work, and the limit is reached when the worm is no longer able to carry off the heat generated fast enough to prevent undue rise in temperature. Furthermore, this limiting speed depends upon the pressure, it being higher for low pressures than for high. A worm having an angle which might be successful at low speed may fail at high speed; but it would seem that any worm which is successful at high speed should also be successful at low, which is in accordance with mechanical instinct.

(Concluded next week.)

▲ ▲ ▲

New Free List for Holland.

By a recent ministerial order the Government of the Netherlands has placed certain iron and steel articles and machinery on the free list, which will particularly interest certain American manufacturers and exporters. Included in the order are ventilators, exhausters and bellows which are worked by steam, gas, petroleum or electric motor only, and are used in factories, on ships, &c. Ventilators for ordinary ventilating purposes and not worked by the afore-mentioned motive power shall remain subject to the existing duty.

lathe and planer tools. This machine cost, probably, as much as a hundred of our ordinary grindstones cost, but I see that it automatically grinds all the tools for 300 high-priced mechanics, and it only works a few hours each day. The skilled mechanics in our country frequently stop their regular work to grind their own tools, and then they do it imperfectly. Your tools are all accurately ground to the best shape by the machine, so that they do more and better work on this account in a given time. I believe that that machine has brains—the brains of the inventor—and it has no doubt revolutionized work of this kind in American machine shops. This is but one case out of many that I have noted."

▲ ▲ ▲

The Fox Machine Company, of Grand Rapids, Mich., has applied a bicycle chain to the movement of the knife carriage of their universal trimmer. This chain takes the place of the rack and pinion and is applied at about the middle of the vertical hight of the carriage, thus doing away with practically all tendency to cramp the carriage within the sliding ways. The result is declared to be a very considerable improvement.

▲ ▲ ▲

Our British contemporary, "The Engineer," names among the important engineering achievements of the past year the great light it has thrown upon the matter of relative railroad speeds in America and England. Over here, however, it seems as though that light has flickered considerably.

Modern Practice with Worm Gearing.—II.

BY F. A. HALSEY.

EXAMPLES FROM PRACTICE.

It is impossible to say who was the first to recognize the significance of the pitch angle as a factor in the satisfactory performance of worm gearing, but it may be mentioned as a matter of interest that the exhibit of the Hewes & Phillips Iron Works at the Newark Industral Exhibition of 1873 included several worm-driven planers, in which the worms were double threaded and had a pitch angle of 15° 15′, a pitch diameter of 3½ inches, a pitch of 3 inches, and a speed, cutting, of 256 and backing of 640 r. p. m., which give pitch line velocities of 237 and 590 feet. This worm was successful, and was many times repeated; but later on Hewes & Phillips were struck by the high belt speed idea, and in order to increase the belt speed they changed the worm to 6.16 p. d., 1¼ inches pitch, single thread; speed, cutting, 446, and backing 1,110 r. p. m., giving a pitch angle of 5° 15′ and pitch line velocities of 720 and 1780 feet. This worm was a failure, and was soon changed to 6.16 p. d., 3½ inches pitch, double thread; speed, cutting, 281, and backing 700 r. p. m., giving an angle of 10° 15′ and pitch line velocities of 452 and 1,130 feet. This worm did better than the last, but not so well as the first. By this time the lesson was learned, and Hewes & Phillips set out to use a worm of 30 degrees pitch angle. Structural considerations, however, prevented the use of so high an angle and they compromised on 20 degrees, the final worm resulting from this experience having a pitch diameter of 2.63 inches, with 3 inches pitch, quadruple thread, the speed cutting being 300 and backing 700 r. p. m., giving pitch line velocities of 205 and 480 feet, and this remained the standard angle as long as these planers were manufactured. The writer recently saw one of these 20 degree worm gears, which had been in use since 1885, opened up, and the wear disclosed was very slight—no shoulder being in existence after twelve years' use. As a result of the experience outlined above this house adopted the standard practice of making the worms as small as possible in diameter, and giving the threads in all cases a pitch angle of 20 degrees. The form of tooth used was the epicychloidal, while the materials used were hard cast iron for the gear and case-hardened open-hearth steel for the worms.

These Hewes & Phillips worms are plotted in Fig. 3 as crosses 1, 2, 3, 4, of which 1 is the 15° 15′, 2 the 5° 15′, 3 the 10° 15′ and 4 the 20°, the first and last being successes and the second and third failures.

In plotting these worms, and all others having pitch line velocities above 200 feet, the crosses are placed near and above the 200 feet curve. It is unfortunate that we have no curves for higher speeds, but Mr. Lewis recommends the use of the 200 feet line for all higher speeds. Leaders connecting different crosses indicate the same worm at different speeds in all cases. The letters *s* and *u* on the dia-

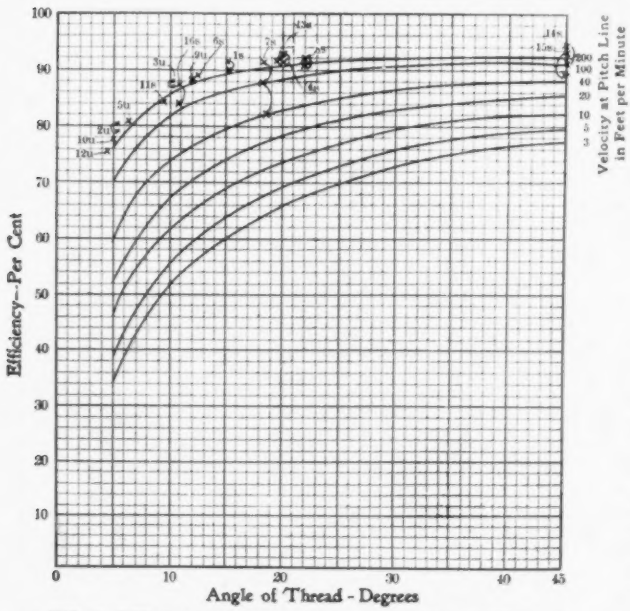


FIG. 3.—RELATION BETWEEN THREAD ANGLE, SPEED AND EFFICIENCY, WITH CASES FROM PRACTICE.

1. Hewes & Phillips, successful, velocity.....237 and 590 ft., steel worm and cast iron gear.
2. Hewes & Phillips, unsuccessful, velocity.....720 " 1,780 " " " " " " " "
3. Hewes & Phillips, unsuccessful, velocity.....452 " 1,130 " " " " " " " "
4. Hewes & Phillips, successful, velocity.....205 " 480 " " " " " " " "
5. Newton Machine Tool Works, unsuccessful, velocity.....372 " " " " bronze "
6. Newton Machine Tool Works, successful, velocity.....375 " " " " " "
7. Newton Machine Tool Works, successful, velocity.....40 to 685 " " " " " "
8. Bertram & Sons, successful, velocity.....155 and 690 " cast / iron " " cast iron "
9. Anonymous, unsuccessful, velocity.....250 " steel " " bronze "
10. Christie, unsuccessful, velocity.215 " " " " cast iron "
11. Christie successful, velocity.....190 " " " " " " " "
12. Christie, unsuccessful, velocity.775 " " " " bronze "
13. Christie, successful, velocity.....228 " " " " " "
14. Anonymous, successful, velocity.116 to 555 " cast / iron " " cast iron "
15. Anonymous, successful, velocity. 53 " 277 " " " " " " " "
16. Anonymous, successful, velocity.118 " 860 " steel " " bronze "

Leaders connecting crosses indicate the same worm at different speeds; resistance of crosses above 200 foot line has no quantitative significance.

gram mean successful or unsuccessful in all cases.

Fig. 4 is a drawing of worm 3 (failure) and figure 5 shows worm 4 (success), and no more instructive pair of drawings could be imagined than these. The pitches are not far different, and what difference there is is in favor of the larger worm. The duty is the same, the gears are about the same diameter, and the revolutions per minute are nearly the same. The essential change is in the increase of the pitch angle by a reduction of the diameter, and this changed failure to success.

The Newton Machine Tool Works use worm gear in many of their machines, notably their cold saw cutting-off machines. In the earlier machines of this class the worm had a pitch diameter of 2⅞ inches, with a pitch of 1 inch, single thread, the revolutions per minute being 765. These figures give a pitch angle of 6° 20′, and a pitch line velocity of 572 feet. This machine could be operated, but not with satisfaction on account of the heating and short life of the worm. The worm was then increased in pitch by making it double threaded, giving a pitch angle of 12° 30′, the speed being reduced to 500 revolutions per minute, giving a pitch line velocity of 375 feet. The change proved to be a great improvement, heavier work than was before possible being done after the change without distress or difficulty, and this worm has since been applied to a large number of machines with entire success. A still later worm used on these machines has a pitch diameter of 3⅞ inches and a pitch of 4 inches, triple threads, giving a pitch angle of 18° 15′, and this is found to be a still further improvement. This last worm is used on a wide variety of machines and at a variety of speeds from 40 to 680 r. p. m., giving pitch line velocities of from 40 to 685 feet, and with uniformly good results. In many cases it is used without an oil cellar, though for comparatively light work. The form of thread used is the involute, and the material is hardened steel for the worm and bronze for the wheel. These Newton worms appear in Fig. 3 as 5, 6, 7, of which 5 is nearly a failure, while 6 and 7 are entirely successful. The second Newton worm—the one appearing in Fig. 3 as 6—is shown in Fig. 6.

Another habitual user of worms is John Bertram & Sons, of Dundas, Ontario, Canada, who employ them in all their planers, and use largely a worm of 3.18 inches pitch diameter, 4 inches pitch, quadruple threads, the speed, cutting, being 186 and reversing 744 r. p. m. These figures give a pitch angle of 22 degrees, and pitch line velocities of 155 and 620 feet. This worm appears in Fig. 3 as 8, the vertical position for the higher speed being again uncertain. These worms are highly successful, as the writer knows from repeated observation. Both worm and wheel are of cast iron, the thread being Brown & Sharpe standard. The Bertram worm is seen in Fig. 7. In reading this drawing it should be remembered that the conventional representation of a worm, with the threads shown by straight lines, shows a larger apparent pitch angle than the true one, as shown by a true projection.

Another case of failure was a worm drive applied to a large boring machine, the worm being 12 inches pitch diameter, 8 inches pitch, quadruple thread, speed 80 r. p. m. and above, worm of forged steel, wheel of bronze, oil cellar lubrication. These figures give a pitch angle of 12 degrees and a pitch line velocity of 250 feet. This worm is located on Fig. 3 as 9.

Still other cases of change from failure to success are supplied by Mr. Jas. Christie, of the Pencoyd Iron Works. The first of these relates to a boring machine, which was, by the makers, supplied with a worm drive having a worm 5½ inches pitch diameter, 1½ inch pitch, single thread, steel worm and cast-iron wheel, average speed 150 r. p. m. These figures give a pitch angle of 5 degrees and a pitch line velocity of 215 feet. This was a failure, but was successfully replaced by a worm of 4⅞ inches pitch diameter, 2½ inches pitch, at the same number of revolutions, which figures give a pitch angle of 9° 15′ and a pitch line speed of 190 feet. These two worms appear as 10 and 11. This successful worm lies in the region of unsuccessful ones, but the influence of the increased lead angle is unmistakable. The fact of its success is probably due to the pressure on the teeth being well below the working strength, or to the speed being moderate, or both.

The second case, of which the data were supplied by Mr. Christie, relates to two heavy milling machines, in which the cutter spindles were driven by worms 6 inches pitch diameter by 1½ inch pitch, single thread. It was found that the cutters could be run much faster than was originally contemplated, and the worms

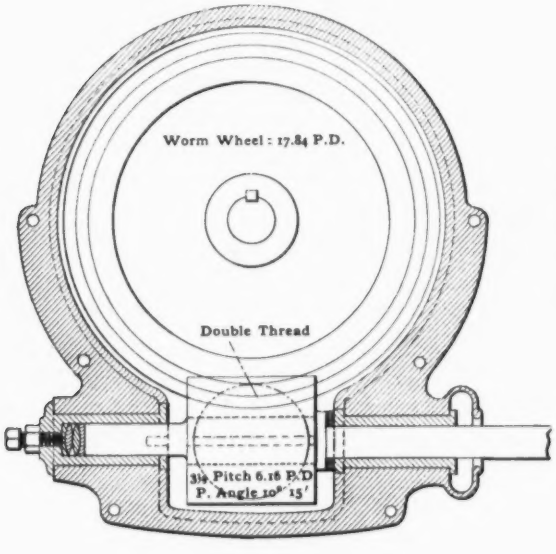


Fig. 4

HEWES & PHILLIPS' UNSUCCESSFUL WORM.

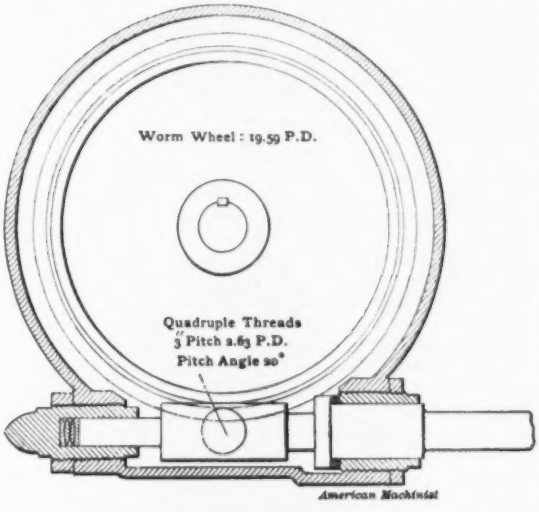


Fig. 5

HEWES & PHILLIPS' SUCCESSFUL WORM.

were consequently speeded up to about 500 r. p. m. In these machines cast-iron wheels were speedily destroyed, while hardened steel worms and bronze wheels would last about a year. Later two more machines were built having steel worms and bronze wheels, the worms being 4½ inches pitch diameter by 5 inches pitch, quadruple threads, speed 280 r. p. m. These worms have been in use six years, and are described as being "good as new." The data given for the first worm give a pitch angle of 4° 30′ and a pitch line velocity of 785 feet. It appears in Fig. 3 as 12. The pitch angle of the second worm is 19° 30′, and its pitch line velocity 328 feet. It appears in Fig. 3 as 13.

Mr. Christie has made many successful changes, of which these are typical, and he now uses worms with great freedom and success. His general conclusion is that good worms begin with those having the pitch about equal to the diameter, giving a pitch angle of 17° 15′.

Three other cases of successful worms under heavy duty are found in milling machines which have been repeated many times. The first two worms would be ordinarily described as spiral gears. The shafts are at right angles and the action is that of worms, and they are properly included here.

The first of these, which appears as 14 in the diagram, has a pitch diameter of 2¼ inches, a pitch angle of 45°, and a speed varying between 180 and 945 r. p. m., giving pitch line velocities of 106 to 555 feet per minute. Both gears are of cast iron. The second, 15 in the diagram, is of the same style, and has the same pitch diameter, with speeds varying between 90 and 472 r. p. m., giving pitch line velocities of 53 to 277 feet per minute. The third, 16 in the diagram, is a true worm, 2¼ inches pitch diameter, lead 1,333, triple thread, speed 200 to 1,442 r. p. m., bronze wheel and hardened steel worm. These figures give a pitch angle of 10° 45′, and a pitch line velocity of 118 to 845 feet per minute. While this worm is entirely successful, it was at first a failure, and was made successful only by careful attention to the materials used.

LIMITING SPEEDS AND PRESSURES.

A very important point connected with worm design, and one on which data are very scant, is the limiting pressures for various speeds at which cutting begins. The paper by Mr. Lewis contains some information on this subject, and the accompanying table supplied by Mr. Christie, from experiments made by him, supplies the most definite additional data on the subject known to the writer. In all cases the worms were of hardened steel and the worm wheels of cast iron. Lubrication by an oil bath.

	Single Thread Worm 1″ Pitch 2¾ Pitch Diam.				Double Thread Worm 2″ Pitch 2¾ Pitch Diam.			Double Thread Worm 2½″ Pitch 4¼ Pitch Diam.		
Revolutions per min ..	128	201	272	425	128	201	272	201	272	425
Velocity at pitch line in feet per min.....	96	150	205	320	96	150	205	235	319	498
Limiting pressure in pounds.....	1,700	1,300	1,100	700	1,100	1,100	1,100	1,100	700	400

LIMITING SPEEDS AND PRESSURES OF WORM GEARING.

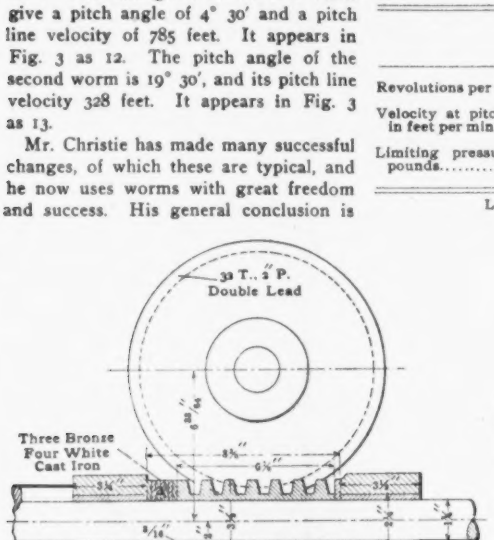


Fig. 6

THE NEWTON WORM AND STEP.

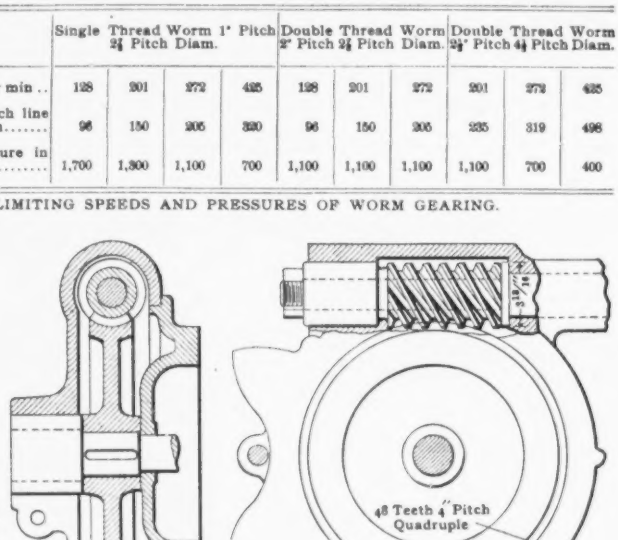


Fig. 7

THE BERTRAM WORM.

There is real need of a comprehensive series of experiments on this subject. It is obvious enough that a worm, otherwise well designed, might fail from having too high a speed for its load. Were such data at hand it would seem that with existing knowledge of effect of the speed and angle of the thread, worm design might be made a matter of comparative certainty. Especially should the behavior of worms at speeds above 200 feet per minute be subjected to further experiment, as it is frequently necessary to use speeds above that figure, and there can be no doubt that higher speeds are entirely feasible if suitable pressures accompany them. The speed as a factor should be kept in mind equally with the pitch angle. A worm may fail because of too high a pitch line velocity as well as because of too low a pitch angle.

The number of cases cited is too few for certainty in drawing general conclusions, but the testimony is unmistakable in its confirmation of the theory of the influence of the angle of the thread. It will be seen that every case having an angle above 12° 30′ was successful, and every case below 9° unsuccessful, the overlapping of the successful and unsuccessful worms in the intervening region being what is to be expected in the border region between good and bad practice. This band of uncertain results is in fact narrower than we would have any right to expect from a collection of data from miscellaneous sources, and could the inquiry be widened in scope the width of this band would doubtless be increased. As throwing light on these cases it should be remembered that case 16 is known to have been made successful only by careful attention to the material used, the first worms made having been failures, and that 3, which is near 16, and was a failure, had an excessive speed, while 11 at a lower angle, and a success, had a very moderate speed. At a higher speed 11 would probably have failed, and at a lower speed 3 would probably have been a success. It is believed that Fig. 3 points out clearly the nature of the worm problem and the conditions of success in its solution.

STEP BEARINGS.

The step bearings of worms have been a source of trouble alongside of the worm

. It is obvious enough that the in-se of the thread angle will relieve step of wear as well as the worm ds. Expedients are possible with tep, however, which are not avail-with the worm. Ball and roller step ngs have been extensively used, and e some have been successful with , the general results are believed to been unsatisfactory. The troubles ball bearings arise from the ten-y of the balls to break up under heavy and to score the pressure plates, conical rollers, which geometrical derations call for, have in some in-es made trouble from their outward l pressure cutting out the confining

The multiple washer thrust bear-s used by many, and is undoubtedly ly successful. Many of the readers is article have no doubt seen this rn of bearing without reflecting the principle which lies at the bot-of it. When several loose washers nterposed between the shaft collar he face of the shaft bearing, it is ob-that slipping may occur between air of faces, and that this slipping take place between those surfaces at the moment offer the least fric-

Should these surfaces from any increase their resistance the slip-will be at once transferred to an-point, the various surfaces acting as l safety valves to one another, any e which gets into the condition of ent heating or cutting being at relieved by another taking up the

Fig. 6 shows one of these bear-as made by the Newton Machine Works. The Newton Works former-llowed the usual practice and made vashers *a* alternately of hardened and bronze, but consider that they improved on this by substituting cast iron for the steel. These cast-re obtained from the malleable iron ries, and are in fact unannealed able castings. Of course these cast-cannot be machined, and they are ore prepared for use by grinding cup-shaped emery wheel. They are ed into a socket on the end of a which is revolved by hand, and are presented to the face of the cup-l wheel. This plan results in the ng marks crossing the faces in all ons, instead of being in circles as he-finished pieces. All mechanics stand the advantage of having the narks in a direction different from f the motion of the parts, which ad-e this method of construction se-

Another feature of the Newton gs consists in making the holes in vashers larger than the shaft on they are placed. This construction uces an irregular compound mo-of the surfaces upon one another, lvantages of which are well under-

In the Newton washers the holes 32 inch larger than the shaft, though Mr. Newton considers that this might be increased with probably good results.

Three radial oil grooves are cast in each face of these disks, the use of which is obvious. The Hewes & Phillips step, at the right-hand bearing, will be seen to include three washers, while the left-hand step has lenticular-shaped disks—a pattern which has also found favor elsewhere.

▲ ▲ ▲

Errata.

In spite of careful corrections of proof, our printer made a general mess of the formulas which appeared in last week's installment of the article on "Modern Practice with Worm Gearing." The first equation for the efficiency of worms without steps should have read

$$e = \frac{\tan \alpha\ (1 - f \tan \alpha)}{\tan \alpha + f}$$

in which

e = efficiency.

α = angle of thread, being the angle $d\ f\ i$ of Fig. 1.

f = coefficient of friction.

The equation for the efficiency of worms with steps should have read:

$$e = \frac{\tan \alpha\ (1 - f \tan \alpha)}{\tan \alpha + 2f} \quad \text{(approximately)}.$$

The equation for tan α at maximum efficiency of worm thread alone should have read:

$$\tan \alpha = \sqrt{1 + f^2} - f$$

Substituting the value of f (.05) this becomes

tan α for maximum efficiency = .9512.

▲ ▲ ▲

Electrical Distribution of Power.

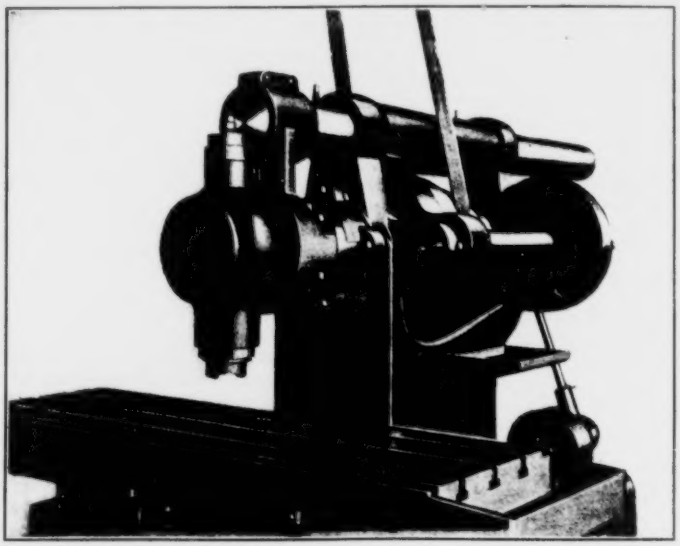
BY WILLIAM O. WEBBER.

I was recently somewhat surprised to read that the driving of factories by electric motors in Europe and on the continent is still regarded as an experimental or problematical thing to do. And yet I do not think that the advantages to be derived from this method of driving are as yet fully appreciated in this country. In recent years it has been my privilege to plan out the electrical driving for a number of factories of different kinds, and I have always, in the first place, ascertained just what saving could be made by driving factories electrically, both from steam and water power as a source, as against driving them directly by shafting and belting. I think, in the first place, that very few people realize the large per cent. of loss in factories of all kinds due to shafting and belting. The per cent. of loss in this way is not only very great, but very variable, and it not only varies very largely from one type of factory to another, but there is also a large variation in different factories of the same type and doing the same class of work. Probably one of the best examples of a small loss of power from these causes is a modern high speed cotton mill, where the total loss does not exceed 18 per cent., whereas some of the older cotton factories lose as much as 25 per cent. To go to the other extreme, the largest loss is in such plants as large locomotive works, boiler shops, bridge works and other plants, where the machine tools are large and are distributed at intervals over a large floor area. In this type of factory the loss, determined by actual tests, runs as high as 80 per cent. Machine shops and wood-working establishments probably come next, the loss being from 50 to 60 per cent., and I have recently tested some woollen and felting mills where the per cent. of loss was from 35 to 40 per cent. I have also made a number of tests recently in warehouse buildings, in large cities where power is furnished to a number of small industries on each floor, and in these cases the loss of power in shafting and belting is a very large per cent. of the total power developed by the engines.

Another very much misunderstood question is that of the relative cost of steam and water power. Of late years there has been a very strong prejudice in favor of steam power, it being generally believed that, by reason of improved boilers and engines, almost all steam power could be produced for $25 per horse-power per year; whereas, as a matter of fact, it is only in large factories, using large compound condensing engines, that this figure can be attained. The ordinary small factory, with an engine of, say, from 100 to 125 horse-power, running 10 hours per day for 308 days in the year, with coal at $3 per ton, will find it impossible to produce a horse-power for less than $53 per annum; and if the same factory is run 365 days in the year, 24 hours per day, the cost on the same basis would be $76, or, if run 24 hours per day for 308 days in the year on the same basis, the cost per annum would be $69. On smaller engines than these just cited the costs would be increased; so that for 308 days of 10 hours the power for a 50 horse-power engine would be nearly $100 per annum.

On the other hand, as we go toward larger plants, these costs decrease, so that 200 horse-power should be obtained for $45; 300 horse-power, for $37.50; 400 horse-power, for $33; 500 horse-power, for $30 per horse-power; and I find that we do not reach the figure of $25 per horse-power until we get as high as 850 horse-power. As the extreme low limit, I believe recent figures of a large thread mill making 2,000 horse-power under extremely favorable conditions, have brought the cost slightly under $12 per horse-power; but this is exceptional.

On the other hand, the horse-power from falling water is relatively much cheaper for small plants. I believe that a small 100 horse-power water plant would produce a horse-power for $33 per annum, and 200 horse-power from water has been produced for $13 per annum,



VERTICAL SPINDLE MILLING HEAD FOR CINCINNATI MILLER.

New Vertical Spindle Milling Head.

We show herewith a photograph and detail section drawing of a new vertical spindle milling head for use on heavy knee-type milling machines. The photograph shows the head attached to a machine. The drawing, which is a section on a vertical plane through the horizontal and vertical spindles, shows the construction and size, and is self-explanatory. The head can be swiveled in a vertical plane through 360 degrees. The circle bearing the graduations is divided into degrees and is 8⅝ inches in diameter, so that graduations are readily seen and accurately set. The cutter shanks are clutched to the spindle, as shown, so that this takes the place of the usual tang on the end of shanks. In this case the ends of the shanks are tapped ⅝'-11, to fit the bolt shown and by which they are firmly secured. The bolt is provided with a shoulder near its head, so it can be used for backing a shank out as well as for drawing it in.

The attachment is made by the Cincinnati Milling Machine Company, and is especially designed for use on their No. 3 and No. 4 machines.

Spiral Gears—I.

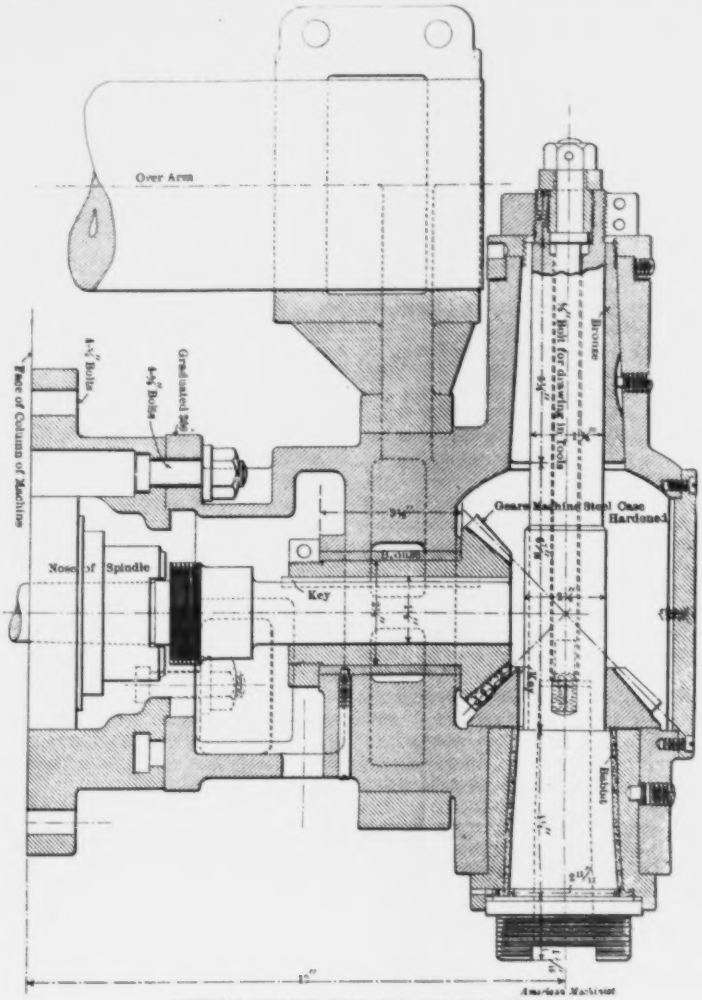
BY F. A. HALSEY.

SPIRAL GEARS COMPARED WITH SPUR GEARS—THE DIFFERENT PITCHES.

The following article may not be essentially any clearer than those which have already been published in these columns, but it presents the subject from a somewhat different standpoint and with greater fullness of illustration, and it may thus assist some in obtaining a comprehensive idea of just what the spiral-gearing problem is.

Spiral gears are not to blame for the undoubted fact that they are somewhat troublesome to lay out, the difficulties of the problem being due to the limitations of workshop facilities and not to the geometrical nature of the gears themselves. It is easy to understand and explain the action of an existing pair of spiral gears. More than this it is easy to lay out a pair of such gears which shall exactly meet all the conditions of the case except one—they cannot, except through rare good luck, be made with the appliances at hand. To be more specific, the circumference cannot usually be divided into an exact whole number of teeth by any stock cutter, and the real problem becomes the readjusting of the diameters of the gears and the angle of the teeth, so that stock cutters shall make an exact whole number of teeth.

With spur gears it is only necessary to multiply the (circumferential) pitch of the cutter by the number of teeth to be cut to obtain the circumference of the gears. With spiral gears this operation gives the length of a portion of a spiral, or, more properly, helix, wound upon the pitch surface. We do not know the angle of this



VERTICAL MILLING HEAD, VERTICAL SECTION.

helix, the diameter of the pitch cylinder upon which it is wrapped or even what part of a complete turn the known portion comprises. The length is known for each gear and nothing more, and it becomes a matter of trial to find the diameters of the gears and the helix angle to suit this portion of the helix and at the same time fill the required center distance.

Fig. 1 is a conventional representation of the pitch surface of a spiral gear, the surface being extended beyond the limits of the gear in order that the two helixes with which we are concerned may be shown. The first of these, *a b c d e f*, is the tooth helix and the second, *a g h d i p*, is the normal helix. The tooth helix is of importance because it defines the angle of the teeth. Given the diameter of the pitch surface, the helix may be defined by the angle *k a l* or by the length *a f*, in which it makes a complete turn—that is, by its pitch. For the determination of the speed ratio of a pair of gears the former method is the more convenient, but the tables supplied with universal milling machines which are used in setting up the machine employ the latter method.

In all spiral gear problems we have too pitches to deal with—the pitch of the tooth helix and the pitch of the teeth. The latter may be measured in several ways. First is the value *a n*, measured on the circumference or the *circumferential pitch*, which is analogous to the pitch of spur gears; second is the value *a o* measured on the normal helix or the *normal pitch*, for which the cutters must be selected; third is the value *a r* measured parallel with the axis or *axial pitch*.* Since the cutters must be selected with reference to the normal pitch the length of the normal helix is naturally of importance in connection with the number of teeth in the gear. The normal pitch multiplied by the number of teeth must naturally equal the length *a g h d* of this helix measured between its intersections *a* and *d* with the helix of a single tooth. Note that the length of the normal helix to be considered is the length *a g h d* between its intersections with the tooth helix and not the length *a g h i p q* of a complete turn around the cylinder. That this is true may be seen by reference to Fig. 2, in which the angle *k a l* is nearly a right angle. It is apparent from this illustration that the length of the normal helix from *a* to *d* takes in all the teeth and that *a o*, multiplied by the number of teeth, must equal *a h p d* and not *a h p q*. This length *a h p d* is always less than *a h p q*, and usually much less. Fig. 3 *A* is a development of Fig. 2 on a reduced scale, *a d* being the developed length of the normal helix. Fig. 3 *B* and Fig. 3 *C* show how with the same circumferential pitch and the same number of teeth but a reduced value of the angle *k a l*, the length of the normal helix which cuts all the teeth grows shorter until it may make but a small part of a complete turn around the cylinder. It is clear that in all cases the line *a d* cuts all the teeth precisely as does the circumference *a a*, which goes completely around the cylinder. It is also clear that if the normal pitch is decided upon at the start, a diameter of cylinder and a helix angle must be found such that the normal pitch, multiplied by the number of teeth, shall equal the length of the normal helix between two intersections with the tooth helix.

It is natural to ask: Why not employ the circumferential pitch and so deal directly with the circumference instead of the normal helix? Because we do not know what it is. The normal pitch is determined by the cutter used, while the circumferential pitch depends also upon the helix angle, and until this angle is known the circumferential pitch is not known.

In the extreme case of a spiral gear in which the helix angle is so small that the gear becomes a single thread worm, as in Fig. 4, points *o* and *d* coincide and the length of the helix between *a* and *d* becomes the normal pitch. It is, however, true as before that the normal pitch, multiplied by the number of teeth, which is now one, is still equal to the length of the normal helix between two intersections with the tooth helix.

A glance at Fig. 3 will show that in gears of the same diameter the length of the normal helix* grows shorter as the angle *k a l* grows less, and hence that it and its gear will contain successively fewer and fewer teeth of the same normal pitch. That is to say, the number of teeth in a gear varies with the helix angle as well as with the diameter and *the number of teeth in two gears of the same normal pitch is not necessarily proportional to the diameters.* In fact, it is never so proportional, except when the angle *k a l* is equal to 45 degrees. *The diametral pitch of the cutters and the diameter of the gear thus do not determine the number of teeth.*

The two facts thus developed are fundamental and will bear re-stating:

First, *the number of teeth is equal to the length of the normal helix divided by the normal pitch.*

Second, *the numbers of teeth in a pair of gears are not proportional to the diameters, except when the angle of the tooth helix is 45 degrees.*

THE SPEED RATIO.

Fig. 5 illustrates the simplest possible case of a pair of spiral gears. The gears are of equal size and the tooth helix has an angle of 45 degrees. Such a pair of gears will obviously run at the same speed—that is, have a speed ratio of 1—and as obviously both will have the same number of teeth. Now, unlike spur gears, there are two ways in which the speed ratio of such a pair of spiral-gears may be varied. First, the diameters of the gears may be changed, as with spur gears, the angle of the tooth helix remaining unchanged, as in Fig. 6; and second, the angle of the helix may be changed, the diameters of the gears remaining unchanged, as in Fig. 7. These methods act in very different ways. The first method is analogous to the procedure with spur gears. As with spur gears, the circumferential or pitch line speed of the two gears remains, as before the change, equal, but the length of the circumference of the two gears is unequal and the larger one thus has a less number of revolutions than the smaller one. The second method is entirely unlike anything seen in connection with spur gears. By it the pitch line speeds of the two gears are made unequal, and hence, while their diameters are equal, the lower one revolves the more slowly. This points out another fundamental difference between spiral and spur gears: With spiral gears, unless the helix angle is 45 degrees, *the pitch line speeds of two mating gears are not the same.*

The two methods of changing the speed ratio shown in Figs. 6 and 7 may be combined. That is, part of the desired change in speed may be obtained by changing the diameters of the gears and the remainder by changing the angle of the helix. Given the speed ratio and the diameter of one of the gears, we may assume a helix angle and find a diameter for the second gear to go with it which shall give the desired speed ratio and, having done this, a second angle may be assumed and a second diameter be found. There are thus an indefinite number of combinations of angles and diameters which will give the required speed ratio. Note, however, that with the diameter of one gear fixed, every change in the diameter of the other changes the distance between centers, that not every angle of helix can be obtained by the gears which are furnished with universal milling machines, and that if ready-made cutters are to be used, the lengths of both normal helixes must be exact multiples of the normal pitch of the teeth. The problem of designing spiral gears thus consists of finding a pair which shall have a given center distance, helix angles which can be cut with the means at hand, and such a normal pitch that stock cutters can be used. Remove these restrictions and laying out a pair of spiral gears becomes simple. It is, in fact, frequently necessary to remove one of them, namely, the helix angle limitation, by making new gears for the spiral head which shall cut the angle desired.

Geometrically speaking, there is a wide range of choice in the helix angle. As regards the desirability of different angles

*Of two mating gears the circumferential pitch of one is equal to the axial pitch of the other, and *vice versa*. The axial and circumferential pitches are of small importance, except in the case of worm gearing. In making a worm we deal with axial pitch, and in making a worm wheel, with circumferential pitch. In such spiral gears as are made with a formed milling cutter (not a hob) we are concerned chiefly with normal pitch.

*"Length of normal helix" is to be understood as meaning the length of that helix between two intersections with the same tooth helix.

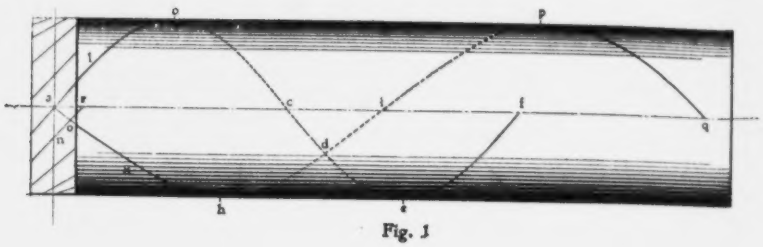


Fig. 1

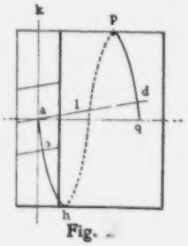


Fig. 2

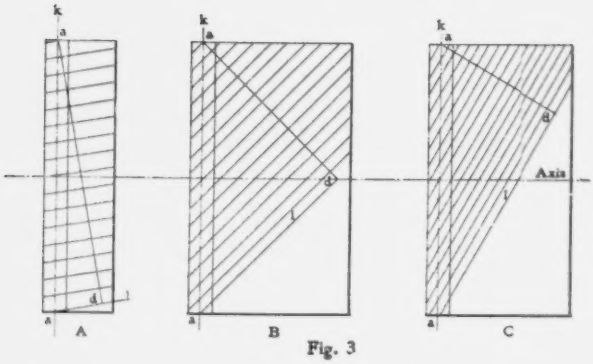


Fig. 3

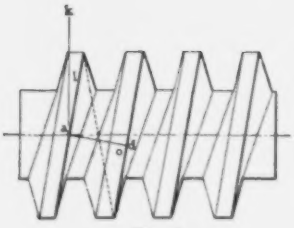


Fig. 4

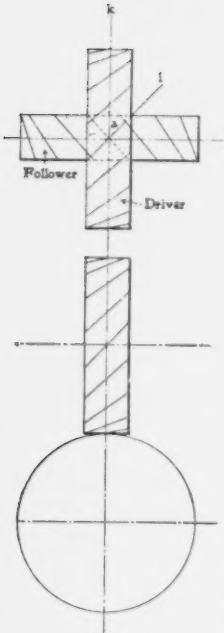


Fig. 5

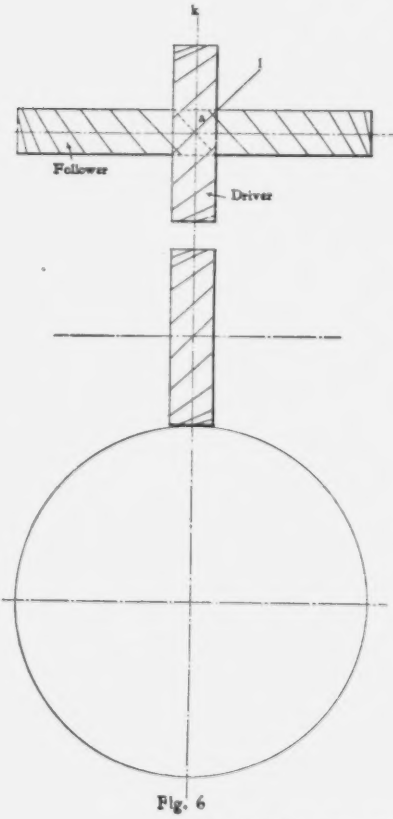


Fig. 6

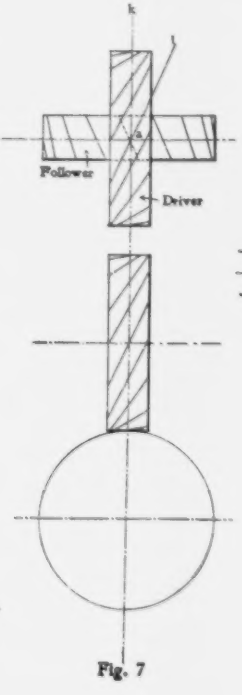


Fig. 7

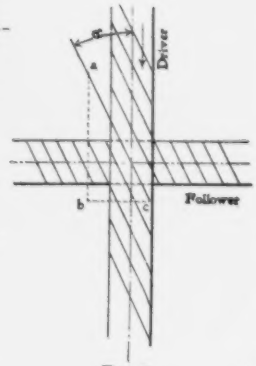


Fig. 8

THE ACTION OF SPIRAL GEARING.

from the standpoint of durability, the conditions are essentially the same as in worm gearing. Reference to the article, "Modern Practice with Worm Gearing," published in the issues of January 13 and 20, 1898, will show that the most favorable angle for durability is 45 degrees. There is, however, but a trifling increase in wear down to 30 degrees, no serious increase down to 20 degrees, and no destructive increase down to about 12 degrees. Where gears are to transmit considerable power the best results should attend the use of angles between 30 and 45 degrees, while angles as low as 20 degrees may be used without hesitation, and as low as 12 de-

grees if the gears are to run in an oil bath or do light work only. The angle may also be increased above 45 degrees by similar amounts and with similar results.

Fig. 8 is a development of the gears of Fig. 7, the angle α of Fig. 8 being equal to $k\,a\,l$ of Fig. 7, but in reversed position, because in Fig. 7 the upper side of the driver is seen, while in Fig. 8 the direction of the teeth is that of the lower side of the driver.

It is clear that if the driver move in the direction of the arrow it will, while moving the distance $a\,b$, push the driven gear the distance $b\,c$, and the pitch line speeds will have the relation:

$$\frac{\text{p.l. speed follower}}{\text{p.l. speed driver}} = \frac{b\,c}{b\,a} = \text{tan. } \alpha.$$

If the gears have the same diameters, their number of revolutions will be in the same ratio as their pitch line speeds—that is:

$$\frac{\text{rev. follower}}{\text{rev. driver}} = \text{tan. } \alpha$$

or

$$\text{rev. follower} = \text{rev. driver} \times \text{tan. } \alpha.$$

If the diameter of the follower be increased, its number of revolutions will be reduced in the same ratio—that is:

$$\text{rev. follower} = \frac{\text{diam. driver}}{\text{diam. follower}} \times \text{rev. driver} \times \text{tan. } \alpha,$$

or

$$\frac{\text{rev. follower}}{\text{rev. driver}} = \frac{\text{diam. driver}}{\text{diam. follower}} \times \text{tan. } \alpha,$$

the angle α being taken from the driver.

This is a complete formula for the speed ratio of spiral gears having shafts at right angles. But for the limitations imposed by the use of stock cutters it, together with the fact that the sum of the diameters of the gears must equal twice the center distance, would be all that is required for designing such gears. Note that it differs from the corresponding formula for spur gears only by the introduction of the factor tan. α.

(*Continued next week.*)

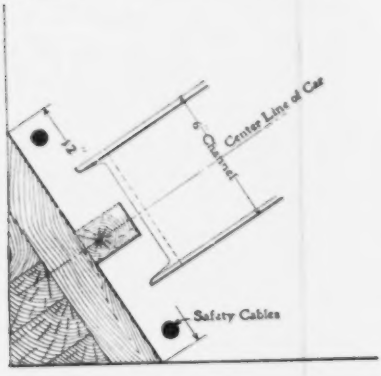


Fig. 1

A Graphical Method of Laying Out the Corner of an Elevator Car.

BY F. B. KLEINHAUS.

The corner of an elevator hatch has been found a convenient place for the guide, which, as a usual thing, is laid out by a trial method. Twelve inches across the corner is a common requirement for the safety device (see Fig. 1). When the car is square it is easy to lay off a line 12 inches long across the corner at an angle of 45 degrees to the center line, but ninety-nine times out of a hundred the car isn't square, and then the problem is not so easy.

The usual method is to take two triangles, placing the right angle of one against the side of the other, and, having found the center of the car, the triangles are slid around until a position is found where the center line is 6 inches from the line of the hatchway on either side. Anyone who has had to lay off the corners in this way will appreciate the graphical method shown in Fig. 2. The center of the car is shown at C, and $A\,O\,B$ is the line of the hatchway. It is required to find a line $D\,G$ in such a position that a normal to its center F will pass through the center C.

From O, as a center, with a radius r equal to 6 inches, describe the arc shown. Select two points D_1 and D_2, one above, and the other below the point where you think D would come; connect them to the center C, and describe the semicircles E^1 and E_2 on them. With a radius of 6 inches and D_1 and D_2 as centers, describe arcs as shown, cutting E_1 and E_2 at the points S and R respectively. Through S and R draw a straight line which will cut the original arc, struck from O, at some point F. Join F and C, and through F draw a line $D\,G$ at right angles to $F\,C$. This line will be 12 inches long, and will have $F\,C$ normal at its center, which is the required condition.

As a proof, we know that the center F of the line $D\,G$ describes a quadrant of a circle when it is made to slide on the right angle $A\,O\,B$, the radius of this circle being r. F is therefore in the arc struck from the point O, with a radius r. If another curve can be found which contains F, their intersection will determine the point.

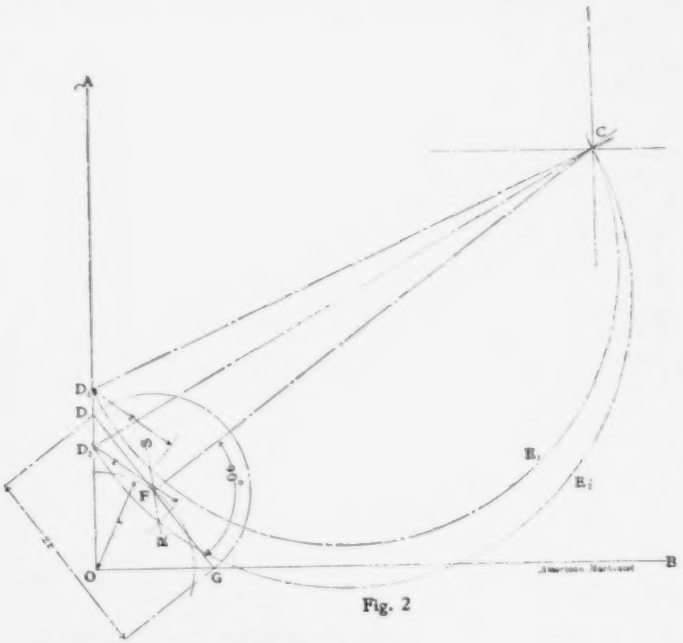


Fig. 2

LAYING OFF THE CORNERS OF AN ELEVATOR HATCH.

Referring to Fig. 3, the line $D\,G$ is shown with $F\,C$ normal at its center. From D as a center, and r as a radius, strike an arc as shown. This arc will pass through F, $D\,G$ being equal to $2r$. $D\,F\,C$ is a right angle, and therefore if we strike a semicircle on $D\,C$ it will pass through F. By taking a series of points D_1, D_2, D_3, etc., along $A\,O$, connecting them to the center, describing semicircles on them, and then from each point striking an arc, with the radius r as shown, a series of points K_1, K_2, K_3, etc., will be determined. Connecting them by a line $K_1\,K_3$, this line is seen to be straight for a considerable distance on each side of F. It is therefore only necessary to make the construction for two points, in order to determine the line.

One other thing will be noticed, namely, that the centers of the semicircles struck

the corners, and consequently it was necessary to accomplish the act of making these changes as nearly instantaneously as possible. This explanation is deemed necessary because the experiment was as much a test on the machine as it was a trial of the method. The two are inseparable so far as the data given in this article are concerned. The cutter used was made by the Cincinnati Milling Machine Company.

CHAS. S. GINGRICH.

Cincinnati, Ohio.

Spiral Gears—II.

BY F. A. HALSEY.

THE PRELIMINARY SOLUTION.

The simple formula for the speed given at the conclusion of the last article will be needed repeatedly, and had best be put in algebraic form.

Let r_1 = revolutions of driver,
r_2 = revolutions of follower,
d_1 = diameter of driver,
d_2 = diameter of follower,
α = helix angle of driver.

Then this formula becomes:

$$\frac{r_2}{r_1} = \frac{d_1}{d_2} \tan. \alpha \qquad (1)$$

In any actual case the speeds are given and the diameters and helix angle must be found. We may assume a ratio for the diameters and find the angle, or we may assume an angle and find the ratio of diameters. It is desirable to assume the angle first, as on it depends, largely, the durability of the gears. To do this the above formula may be more conveniently written:

$$\frac{d_2}{d_1} = \frac{r_1}{r_2} \tan. \alpha \qquad (2)$$

The sum of the diameters must equal twice the center distance, which we may call C. That is:

$$d_1 + d_2 = 2C,$$

or

$$d_2 = 2C - d_1.$$

Substituting this value for d_2 in (2) we obtain:

$$\frac{2C - d_1}{d_1} = \frac{r_1}{r_2} \tan. \alpha$$

which, solved for d_1, becomes:

$$d_1 = \frac{2C}{\frac{r_1}{r_2} \tan. \alpha + 1} \qquad (3)$$

Having assumed a value for α and substituted its tangent and the ratio of the desired speeds in (3), we find a value for d_1, and, having found d_1, d_2 may obviously be found by subtracting d_1 from $2C$.

Such a solution is complete in a geometrical sense, and if it were feasible to make a cutter to suit each case, it would be complete in a practical sense also. When, however, we go a step further and find the length of the normal helixes, the probabilities are all against their being exact multiples of the pitch of any stock cutter. The solution so obtained must therefore be considered as provisional and be modified to suit the cutters to be used. When the adjustment to suit the cutters has been made, it is still a matter of chance if the resulting angle can be cut with the gears supplied with the spiral head of a universal milling machine, and again the probabilities are against it. Eventually one of these conditions can always be met exactly, but both of them rarely. If both are to be met exactly or with close accuracy, it is frequently necessary to make new gears for the spiral head.

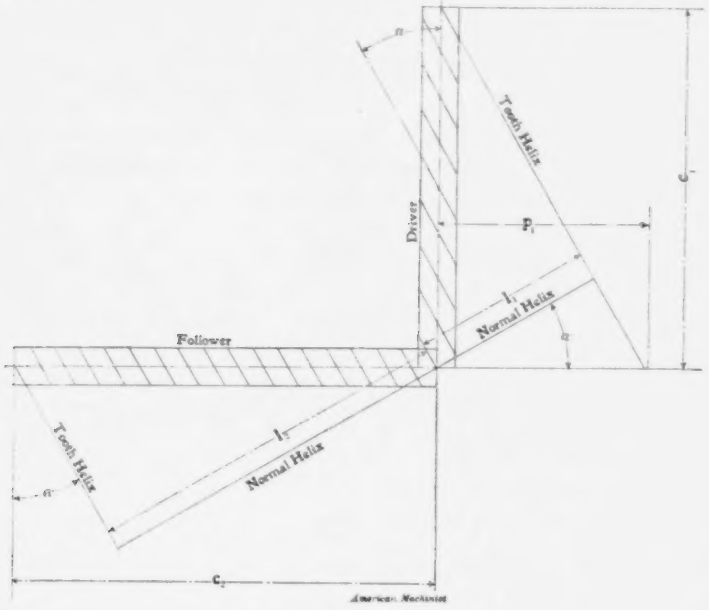


FIG. 9. A PAIR OF GEARS DEVELOPED.

THE LENGTHS OF THE NORMAL HELIXES.

Fig. 9 is the development of a pair of gears placed in the most convenient position for showing the lengths of the normal helixes. The tooth and normal helixes are extended beyond the face of the gears. Let

c_1 = circumference of driver,
c_2 = circumference of follower,
d_1 = diameter of driver,
d_2 = diameter of follower,
l_1 = length of normal helix of driver between intersections with tooth helix,
l_2 = length of normal helix of follower between intersections with tooth helix,
α = tooth helix angle of driver.

Obviously

$$l_1 = c_1 \sin. \alpha,$$
$$= \pi d_1 \sin. \alpha,$$

or

$$\frac{l_1}{\pi} = d_1 \sin. \alpha \qquad (4)$$

$$l_2 = c_2 \cos. \alpha,$$
$$= \pi d_2 \cos. \alpha,$$

or

$$\frac{l_2}{\pi} = d_2 \cos. \alpha \qquad (5)$$

Note that (4) and (5) give the lengths of the normal helixes divided by π and not their actual lengths. This is done because, in dealing with diametral pitch cutters the calculations are made less laborious. Dividing (4) by (5) gives:

$$\frac{l_1}{l_2} = \frac{d_1 \sin. \alpha}{d_2 \cos. \alpha}$$
$$= \frac{d_1}{d_2} \tan. \alpha \qquad (6)$$

Comparing (1) with (6) proves what is almost self-evident, that the lengths of the normal helixes are to each other inversely as the number of revolutions, and hence that *a pitch which will exactly divide the short helix will also divide the long one* and that *the numbers of teeth in the gears are inversely as the speeds.*

A PRACTICAL EXAMPLE.

An example will best illustrate the actual procedure and for this the one given by Mr. De Leeuw in issue No. 2 of last year will answer as well as any. In that example:

$$\frac{\text{revolutions of follower}}{\text{revolutions of driver}} = \frac{r_2}{r_1} = \tfrac{1}{4}$$

and

$$\text{center distance} = C = 4\tfrac{1}{2}$$
$$= 4.468 \text{ inches.}$$

Mr. De Leeuw could not use a helix angle of 45 degrees because it led to a diameter for the driver which was too small for its shaft. We are, at the start, entirely at sea regarding the whole matter; but as an angle of 30 degrees is favorable to durability we may use it as a trial angle and see what it will lead to. Finding the tangent of 30 degrees in a table and substituting it and the value of $\frac{r_1}{r_2}$ in (3) we obtain:

$$d_1 = \frac{2 \times 4.468}{4 \times .57735 + 1}$$
$$= 2.7$$

and

$$d_2 = 2 \times 4.468 - 2.7$$
$$= 6.236.$$

From (4) we find

$$\frac{l_1}{\pi} = 2.7 \times .5$$
$$= 1.35$$

and from (5)

$$\frac{l_2}{\pi} = 6.236 \times .866$$
$$= 5.4.$$

These values of d_1, d_2, $\frac{l_1}{\pi}$, and $\frac{l_2}{\pi}$ are the provisional values belonging with 30 degrees for α.

Mr. De Leeuw desired to use 6 pitch cutters, the circumferential pitch of which is $\frac{\pi}{6} = .5236$. We may find the number of teeth which the normal helixes will contain by dividing their lengths by this circumferential pitch, but

$$l \div \frac{\pi}{6} = \frac{l}{\pi} \times 6.$$

That is, the number of teeth of 6 diametral pitch which the provisional normal helixes will contain may be found by multiplying $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ respectively by 6. Performing this operation we obtain:

$$\frac{l_1}{\pi} \times 6 = 1.35 \times 6$$
$$= 8.1$$

and
$$\frac{l_2}{\pi} \times 6 = 5.4 \times 6$$
$$= 32.4.$$

The provisional normal helixes thus contain 8.1 and 32.4 teeth of the desired pitch, and as these numbers are impossible, we take the nearest whole numbers having the desired ratio of 1 to 4, namely, 8 and 32. That is, we decide to shorten the normal helixes until they contain exactly 8 and 32 teeth.

The meaning of this is shown graphically in Fig. 10. Laying down $a\,b$ and $a\,c$ to represent the circumferences as found above and drawing the normal helixes at an angle of 30 degrees, we have found that the normal helix $a\,d$ of the driver will contain 8 teeth and a little more, and the normal helix $a\,e$ of the follower 32 teeth and a little more. As we cannot have a fraction of a tooth, we decide to cut off the ends of the helixes, making their lengths $a\,d'$ and $a\,c'$.*

FINAL SOLUTION BY CHANGING THE CENTER DISTANCE.

The most obvious way of carrying this out is to simply reduce the diameters of both gears, so as to make their circumferences $a\,b'$ and $a\,c'$ instead of $a\,b$ and $a\,c$. This change obviously reduces the center distance, but at this drawing-board stage of affairs this can often be done, and when it can be done it is the readiest way out of the difficulty. To determine how much to reduce the diameters we must first find the reduced lengths of the normal helixes, which must be such that:

$$\frac{l_1}{\pi} \times 6 = 8$$

or
$$\frac{l_1}{\pi} = \frac{8}{6}$$
$$= 1.333$$

and
$$\frac{l_2}{\pi} \times 6 = 32$$

or
$$\frac{l_2}{\pi} = 5.333.$$

Knowing these corrected values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$, it is easy to find the new diameters. It is apparent from Fig. 10 that the ratio between the provisional and final diameters is the same as that between the lengths of the provisional and final helixes, which latter is 8.1 to 8, or its equal 32.4 to 32. That is:

$$\frac{\text{final diameter}}{\text{provisional diameter}} = \frac{8}{8.1}$$

or

$$\text{final diameter} = \text{provisional diameter} \times \frac{8}{8.1}$$

That is:

$$\text{final } d_1 = 2.7 \times \frac{8}{8.1}$$
$$= 2.667$$

and

$$\text{final } d_2 = 6.236 \times \frac{8}{8.1}$$
$$= 6.159$$

and $d_1 + d_2 = 2.667 + 6.159 = 8.825 =$ twice the new center distance.

GRAPHICAL SOLUTION WITH CHANGED CENTER DISTANCE.

All these determinations may be made graphically as in Fig 11. Lay off $a\,b = 2\,C = 8\frac{13}{16}$ inches. At any convenient distance lay off the indefinite line $c\,d$ parallel to $a\,b$. At c lay off the provisional angle $\alpha = 30$ degrees. Draw $e\,f$ at any convenient point perpendicular to $c\,d$. Take $e\,f$ in the dividers and step it off from e toward d as many times as will represent the ratio of the desired speed of the driver divided by that of the follower. That is, in the present case, lay off $e\,f$ 4 times above e and thus obtain d. Draw $c\,a$ and $d\,b$ and extend them till they meet at g.* Draw $g\,e$, giving $a\,h$ and $b\,h$, which are provisional diameters of driver and follower respectively. Draw $h\,p$ perpendicular to $a\,b$, at h lay down $h\,k$ and $h\,l$ to repeat α, and from h strike arcs $a\,k$ and $b\,l$. Draw $k\,o$ and $n\,l$ perpendicular to $a\,b$, and we have the provisional values:

$$a\,h = d_1$$
$$b\,h = d_2$$
$$h\,o = \frac{l_1}{\pi}$$
$$h\,n = \frac{l_2}{\pi}$$

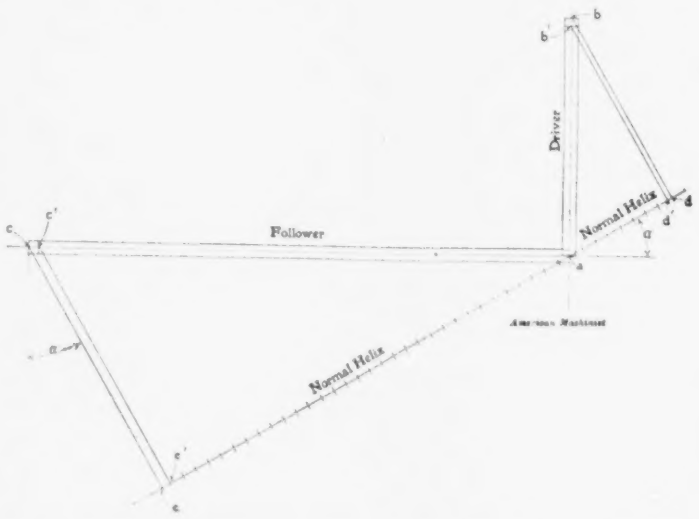


FIG. 10. ADJUSTING THE DIAMETERS WHEN THE CENTER DISTANCE CAN BE CHANGED.

Scale $h\,o$ and $h\,n$ and multiply them by the diametral pitch number — 6. If the results are not whole numbers, as they usually are not, select the nearest whole numbers having the desired speed ratio, and they are the final numbers of teeth. Divide these numbers by the diametral pitch number to obtain the final values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ and lay them down as $h\,o'$ and $h\,n'$. Draw $o'\,k'$ and $l'\,n'$ and $k'\,a'$ and $l'\,b'$, giving:

$a'\,h$ = the final d_1,
$b'\,h$ = the final d_2,
$a'\,b'$ = twice the new center distance.

(Concluded next week.)

*Should the helixes come out a little short instead of a little long, they would be lengthened instead of shortened. Had the helix of the driver been of a length to contain, say, 8.3 teeth, that of the follower would obviously have contained 33.2 teeth, and, in the correction, more than an entire tooth would have been cut from it.

*Had $c\,d$ been taken shorter than $a\,b$, g would have fallen to the left of the diagram, but the construction would otherwise have been unchanged.

Spiral Gears—III.

BY F. A. HALSEY.

FINAL SOLUTION WITH UNCHANGED CENTER DISTANCE.

If the center distance cannot be varied, the condition of things is shown in Fig. 12. Having found that the provisional normal helixes will not contain an exact number of teeth, and cut them off and obtained the smaller circumferences $a\,b'$ and

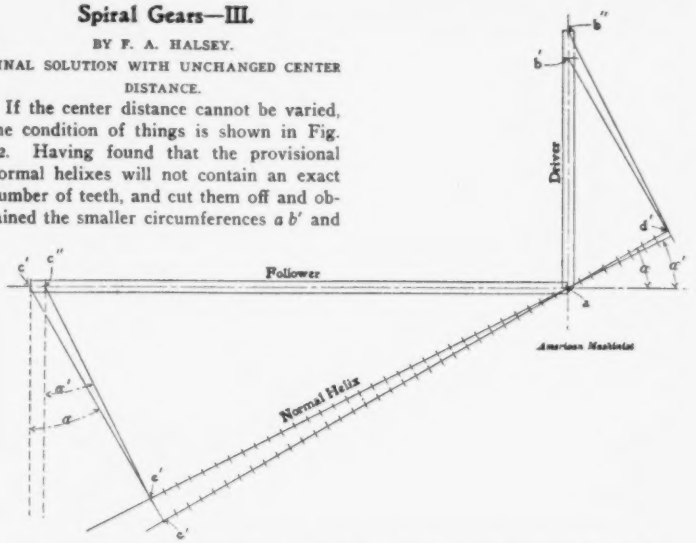


FIG. 12. ADJUSTING THE DIAMETERS WHEN THE CENTER DISTANCE IS FIXED.

$a\,c'$ of Fig. 10, the problem becomes to find a new value of α, indicated in Fig. 12, as α' which shall give such diameters as to restore the old center distance. That is, $a\,b'' + a\,c''$ of Fig. 12 must be equal to the original $a\,b + a\,c$ of Fig. 10. It will be seen by a glance at Fig. 12 that the reduced value of α increases the diameter of the driver, but reduces that of the follower.

It is probable that the correct angle and diameters for this case can be found only by trial. From (4) we have:

$$d_1 = \frac{l_1}{\pi \sin.\ \alpha} \qquad (7)$$

and from (5)

$$d_2 = \frac{l_2}{\pi \cos.\ \alpha} \qquad (8)$$

We also have:

$$d_1 + d_2 = 2C;$$

that is

$$\frac{l_1}{\pi \sin.\ \alpha} + \frac{l_2}{\pi \cos.\ \alpha} = 2C,$$

which easily reduces to:

$$1 + \frac{l_2}{l_1} \tan.\ \alpha = \frac{2C}{\frac{l_1}{\pi}} \sin.\ \alpha \qquad (9)$$

To solve this equation we know that $\frac{l_2}{l_1}$ = the speed ratio = 4 and in the preceding article we found that final $\frac{l_1}{\pi} = 1.333$. Substituting these values and the value of C, the only unknown quantity is α, but, from the form of the equation, α can be found only by trial and error, the result of each trial being a closer and closer approximation to the truth. The operation is simple enough, but it involves the repeated multiplication of decimals. For the earlier steps a slide rule will greatly abbreviate the work, while with a Sexton's omnimeter an accuracy can be obtained sufficient for all the steps and a piece of drudgery be converted into an exhilarating chase. The results which follow were obtained with an omnimeter. Trying the provisional angle of 30 degrees in order to note the result and making the substitutions in (9) we obtain:

$$1 + 4 \times .577 = 6.702 \times .5$$
$$\text{or} \qquad 3.308 = 3.351.$$

This is not correct, as we knew it would not be. The right-hand number is larger than the left-hand number, which will always be the case if our trial value of α is too large, and *vice versa* if it is too small. Trying 28 degrees we obtain:

$$1 + 4 \times .532 = 6.702 \times .469$$
$$\text{or} \qquad 3.13 = 3.145.$$

The right-hand number is still too large, showing 28 degrees to be too large. Trying 26 degrees we obtain:

$$1 + 4 \times .488 = 6.702 \times .438$$
$$\text{or} \qquad 2.953 = 2.935.$$

The right-hand number is now too small, showing that 26 degrees is too small. Trying 26 degrees 30 minutes we obtain:

$$1 + 4 \times .499 = 6.702 \times .446$$
$$\text{or} \qquad 3. = 2.99$$

This angle is still too small, though obviously very nearly correct. Trying 26 degrees and 40 minutes we obtain:

$$1 + 4 \times .502 = 6.702 \times .449$$
$$\text{or} \qquad 3.01 = 3.01.$$

Within the limits of accuracy of the omnimeter this is correct, and as that instrument shows the effect of so small a change in the angle as 10 minutes the result is obviously close enough. It agrees with Mr. De Leeuw's determination. Having found the angle we are now in shape to find the final diameters. Substituting in (7) and (8) we obtain:

$$d_1 = \frac{1.333}{.4488} = 2.971$$

and

$$d_2 = \frac{5.333}{.8936} = 5.968$$

and $5.968 + 2.971 = 8.939$, which is twice the required center distance as closely as can be expected.

GRAPHICAL SOLUTION WITH UNCHANGED CENTER DISTANCE.

These determinations may also be made graphically, as shown in Fig. 13, which repeats the construction of Fig. 11 up to the finding of the provisional values of $a\,h$ and $b\,h$.

In Fig. 11 h is a fixed point, while a and b were not. In the present case a

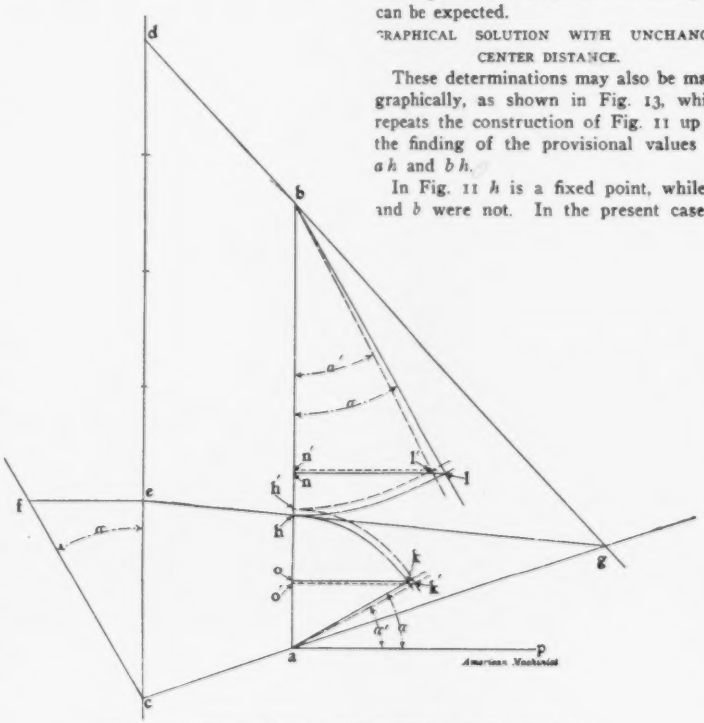


FIG. 13. GRAPHICAL SOLUTION WITH FIXED CENTER DISTANCE.

and b are fixed, but h is not, and to find $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ in the present case it is better to lay off α at a and b instead of at h, as was done in Fig. 11. Therefore lay down α at a and b, as shown, and strike arcs

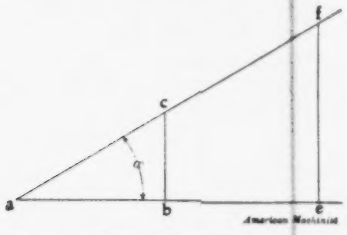


FIG. 14. FINDING THE PITCH OF THE TOOTH HELIX.

$h\,k$ and $h\,l$. Draw $k\,o$ and $l\,n$, giving the provisional values:

$$a\,o = \frac{l_1}{\pi}$$

$$b\,n = \frac{l_2}{\pi}$$

Measure these distances and multiply them by the diametral pitch number—in this case 6—to find the numbers of teeth going with the assumed value of α. If, as is usually the case, the products are not whole numbers, take the nearest whole numbers having the ratio of the desired speeds, divide them by the diametral pitch number and obtain the corrected values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$. Lay off $a\,o'$ and $b\,n'$ equal to these corrected values. Assume a new trial angle, indicated as α', and lay it down at a and b. Draw $o'\,k'$ and $n'\,l'$, and through the intersections k' and l' dr w the dotted arcs. If these arcs meet in tangency at h', then we have the final values:

$$a\,h' = d_1$$

and $$b\,h' = d_2.$$

If the arcs do not thus meet in tangency, assume another value for α and try again.

Graphical methods are sufficiently accurate for many purposes, especially if laid out upon an enlarged scale, and if it is remembered that if the values used for $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ are a little short of the true values, the shortage will be divided among the teeth with the only result of a little slackness in the teeth.

FINDING THE PITCH OF THE TOOTH HELIX.

It now only remains to find the pitch of the tooth helixes in order to set up the machine. In Fig. 9 let

p_1 = pitch of tooth helix of driver,

p_2 = pitch of tooth helix of follower;

then $$p_1 = c_1 \tan.\ \alpha,$$
$$= \pi\, d_1 \tan.\ \alpha,$$

and

$$p_2 = c_2 \cot.\ \alpha,$$
$$= \pi\, d_2 \cot.\ \alpha.$$

Inserting the final values of d_1 d_2 and α we obtain:

$$p_1 = \pi \times 2.971 \times .502,$$
$$= 4.684,$$

and $$p_2 = \pi \times 5.968 \times 1.991,$$
$$= 37.33.$$

These values may be found graphically as in Fig. 14. Lay down α and make $a\,b = \pi\, d_1$ when $b\,c = p_1$. Find $e\,f = \pi\, d_2$ and $a\,e = p_2$.

SPECIAL SOLUTION FOR A HELIX ANGLE OF 45 DEGREES.

Remembering that $\frac{l_2}{l_1} = \frac{r_1}{r_2}$, the latter fraction may be substituted for the former in (9) together with the assumed value of α and the provisional value of $\frac{l_1}{\pi}$ be thus found without first finding the provisional values of d_1 and d_2. The final values of d_1 and d_2 may then be found from (7) and (8). Such a solution is in some respects neater than the one given, but it is believed to be less easily followed and comprehended, and, moreover, it does not, for the general case, furnish the basis of so good a graphical solution. This method is at its best in the case of a helix angle of 45 degrees and the fact that, for this case, tan. α in (9) becomes 1 makes that equation the basis of a neat graphical solution for this special case. This angle does not differ from any other in requiring a change in the center distance if it is to be adhered to. In the nature of the case, if we deny ourselves the liberty of changing the angle, the only recourse is to correct length of the helix by changing the diameters. As this angle is used more than any other—perhaps more than all others—this solution for it is given.

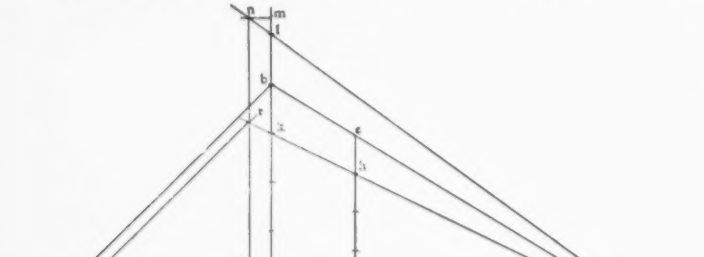


FIG. 15. SPECIAL GRAPHICAL CONSTRUCTION FOR A HELIX ANGLE OF 45 DEGREES.

Remembering that in (9) $\frac{l_2}{l_1} = \frac{r_1}{r_2}$, that tan. $45° = 1$ and that sin. $45° = .7071$, that equation becomes *for this angle only:*

$$1 + \frac{r_1}{r_2} = \frac{1.4142\ C}{\frac{l_1}{\pi}}$$

which may be made to read:

$$\frac{l_1}{\pi} = \frac{1.4142\ C}{1 + \frac{r_1}{r_2}} \qquad (10)$$

Inserting sin. $45° = .7071$ in (7) we have:

$$d_1 = \frac{\frac{l_1}{\pi}}{.7071} \qquad (11)$$

Equations (10) and (11) are all that are needed for solving any case having this helix angle.

Taking up Mr. De Leeuw's problem again and solving it for this angle, we have from (10) for the provisional value:

$$\frac{l_1}{\pi} = \frac{1.4142 \times 4.468}{1 + 4}$$
$$= 1.2637.$$

Multiplying this by the diametral pitch of the cutter to be used, we obtain:

$$1.2637 \times 6 = 7.58$$

as the provisional number of teeth in the driver. As it is an impossible number, we select 8 as the number of teeth and, dividing it by 6, we obtain:

$$\frac{8}{6} = 1.333$$

as the final value of $\frac{l_1}{\pi}$. Substituting this in (11), we obtain:

$$d_1 = \frac{1.333}{.7071}$$
$$= 1.885$$

as the final value of the diameter of the driver. The diameter and number of teeth of the follower for an angle of 45 degrees are found by multiplying the diameter and number of teeth of the driver by the speed ratio. That is:

$$d_2 = 1.885 \times 4$$
$$= 7.540$$

and

number of teeth in follower $= 8 \times 4$
$= 32$

Finally

$$d_1 + d_2 = 1.885 + 7.54$$
$$= 9.425$$
$$=$$ twice the final center distance.

GRAPHICAL SOLUTION FOR AN ANGLE OF 45 DEGREES.

The special graphical solution for this case is given in Fig. 15:

Lay down the base line and at a lay off $a\,b$ at an angle to it of 45 degrees. Make $a\,b = 2\,C$—in this case $8\frac{1}{4}$ inches—and draw the perpendicular $b\,c$. At any convenient point draw the perpendicular $d\,e$,

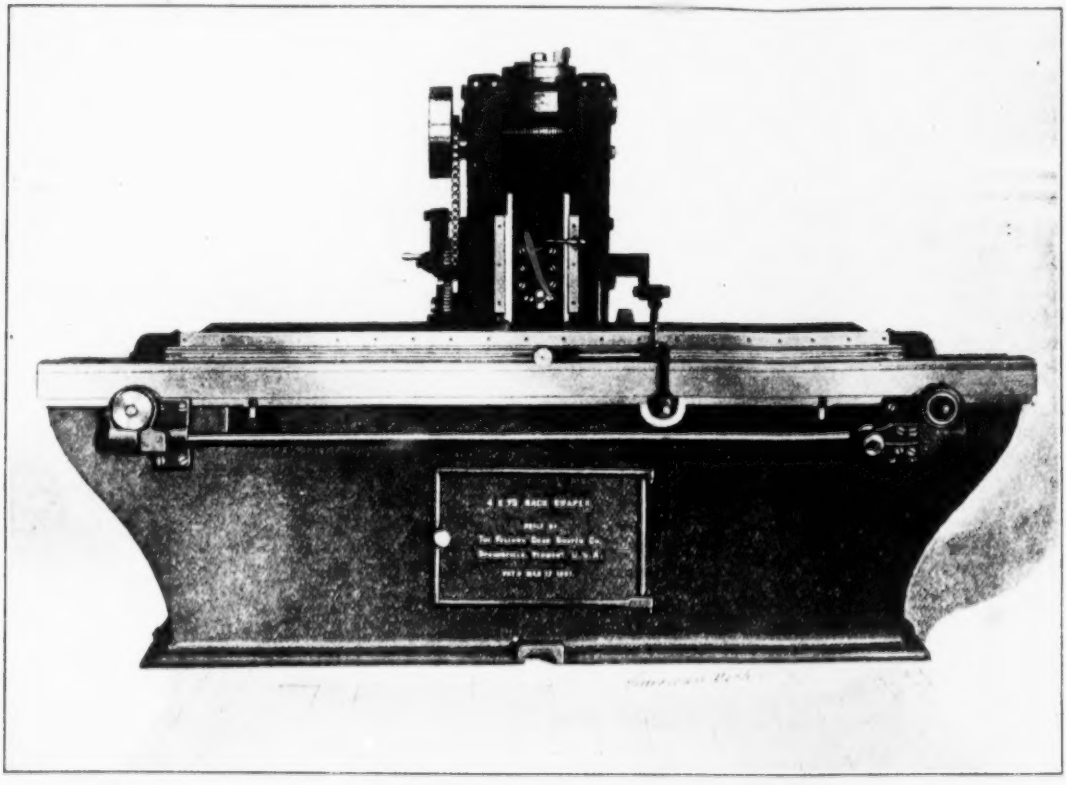


FIG. 1. FRONT VIEW OF FELLOWS RACK SHAPER.

making $d\,f = 1$ inch and $f\,e$ as long in inches as will represent the speed ratio; that is, in the present case, make $f\,e = 4$ inches. Draw $b\,e$ and extend it till it meets the base line at g. Draw $f\,g$ through the first inch from d and $h\,g$ through the fourth inch, giving:

$c\,i$ = the provisional value of $\frac{l_1}{\pi}$

and

$c\,k$ = the provisional value of $\frac{l_2}{\pi}$

Step off $c\,i$ from c as many times as will represent the diametral pitch number—in this case 6—giving l. Measure $c\,l$, which in inches gives the provisional number of teeth in the driver. If not a whole number of inches in length, as it usually is not, locate m such that $c\,m$ equals the nearest whole number of inches—in this case 8, which is the final number of teeth in the driver. Draw $g\,l$, $m\,n$, $n\,o$, $p\,q$ and $r\,s$, and we have:

$o\,p$ = final $\frac{l_1}{\pi}$,

$o\,r$ = final $\frac{l_2}{\pi}$,

$p\,q$ = final d_1,

$r\,s$ = final d_2,

$p\,q + r\,s$ = twice the final center distance.

The number of teeth in the follower equals those in the driver multiplied by the speed ratio.

(*Conclusion.*)

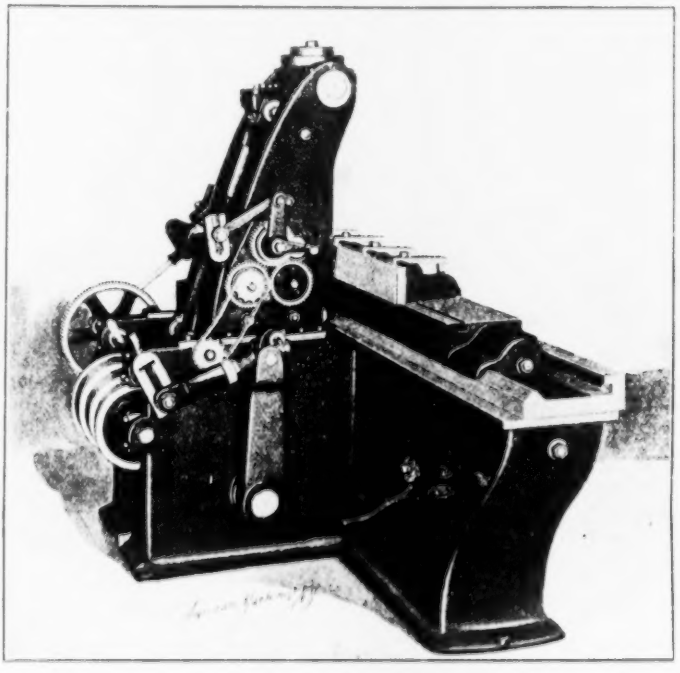
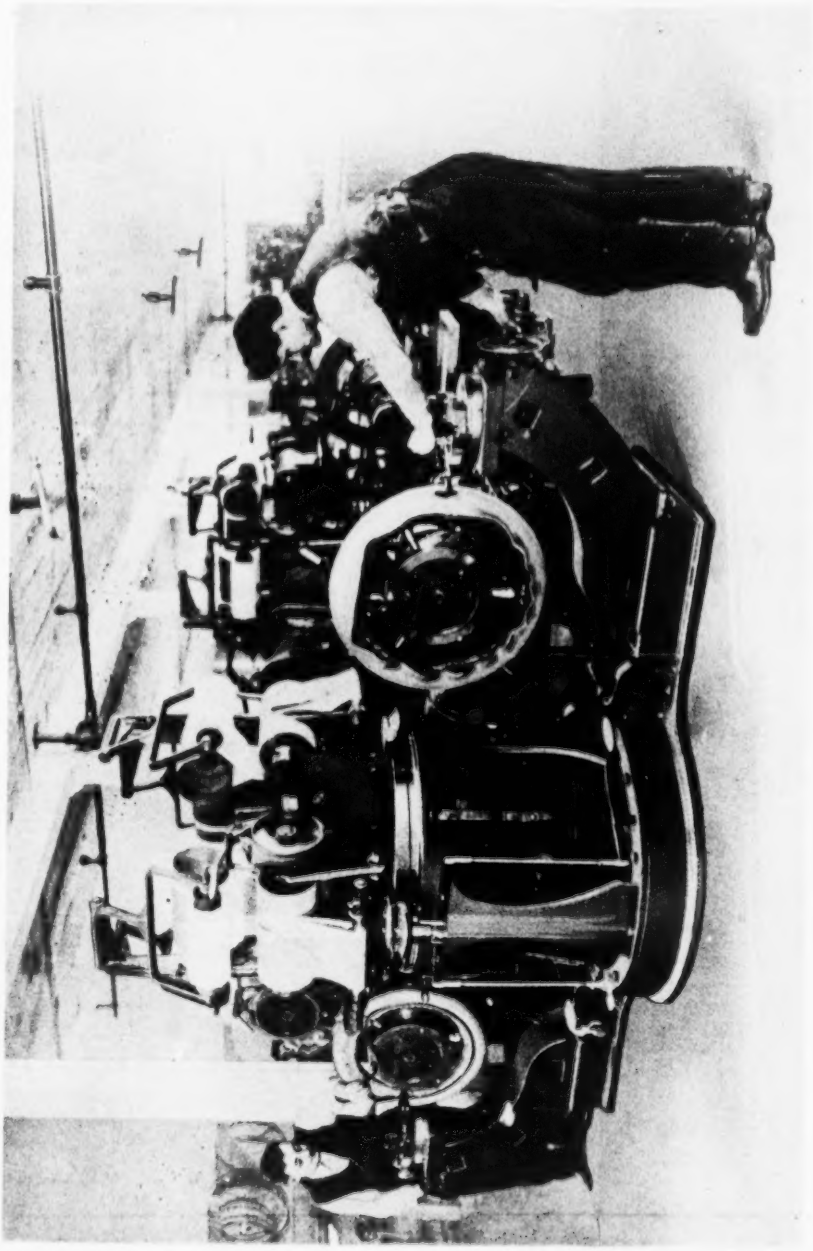
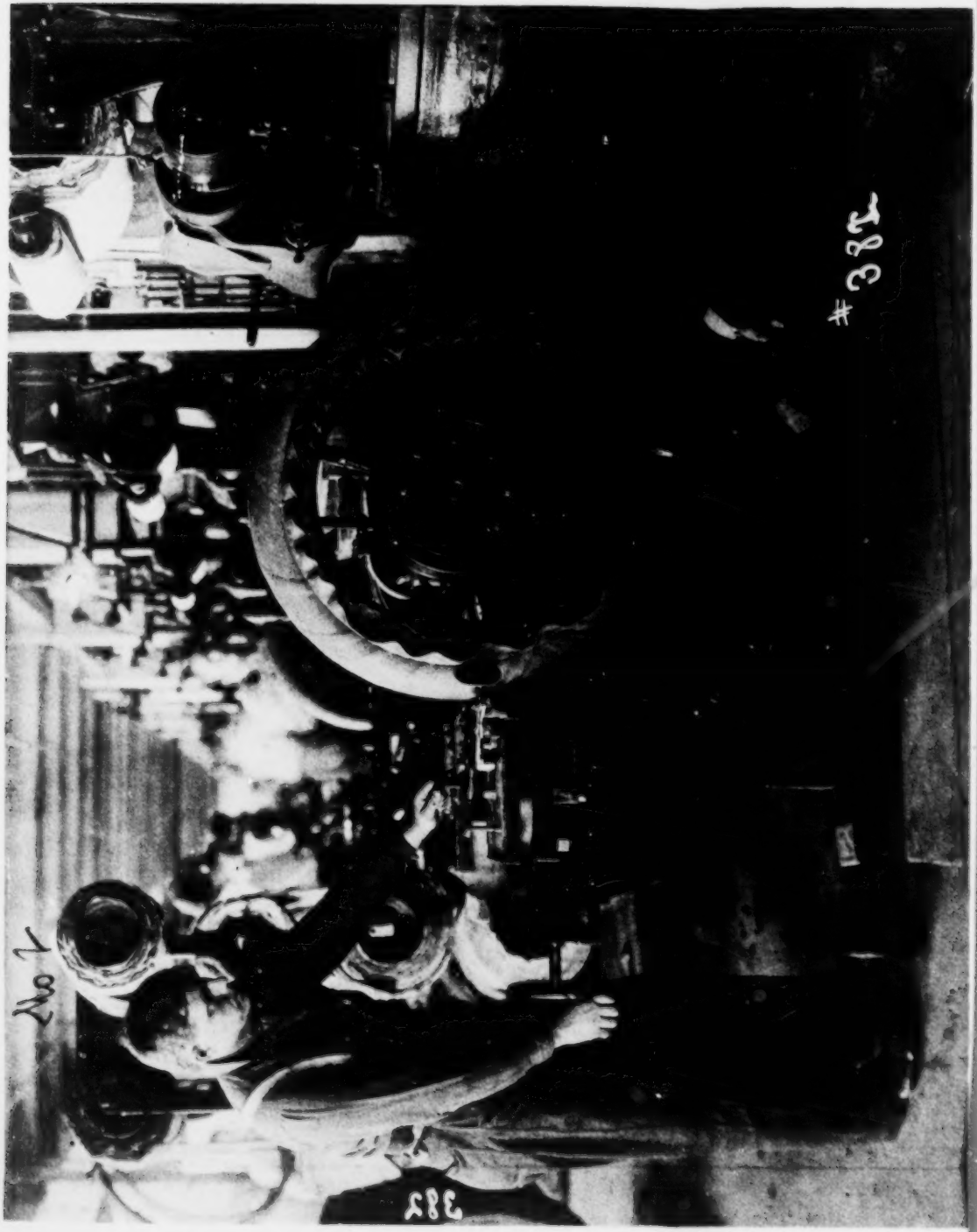


FIG. 2. END VIEW OF RACK SHAPER.

Plaintiff's Exhibit No. 35—Photographs State Machines.
(No. 1.)

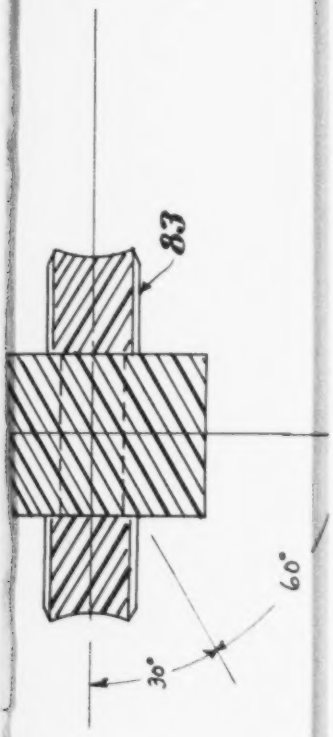


Plaintiff's Exhibit No. 35—Photographs State Machines.
(No. 2.)



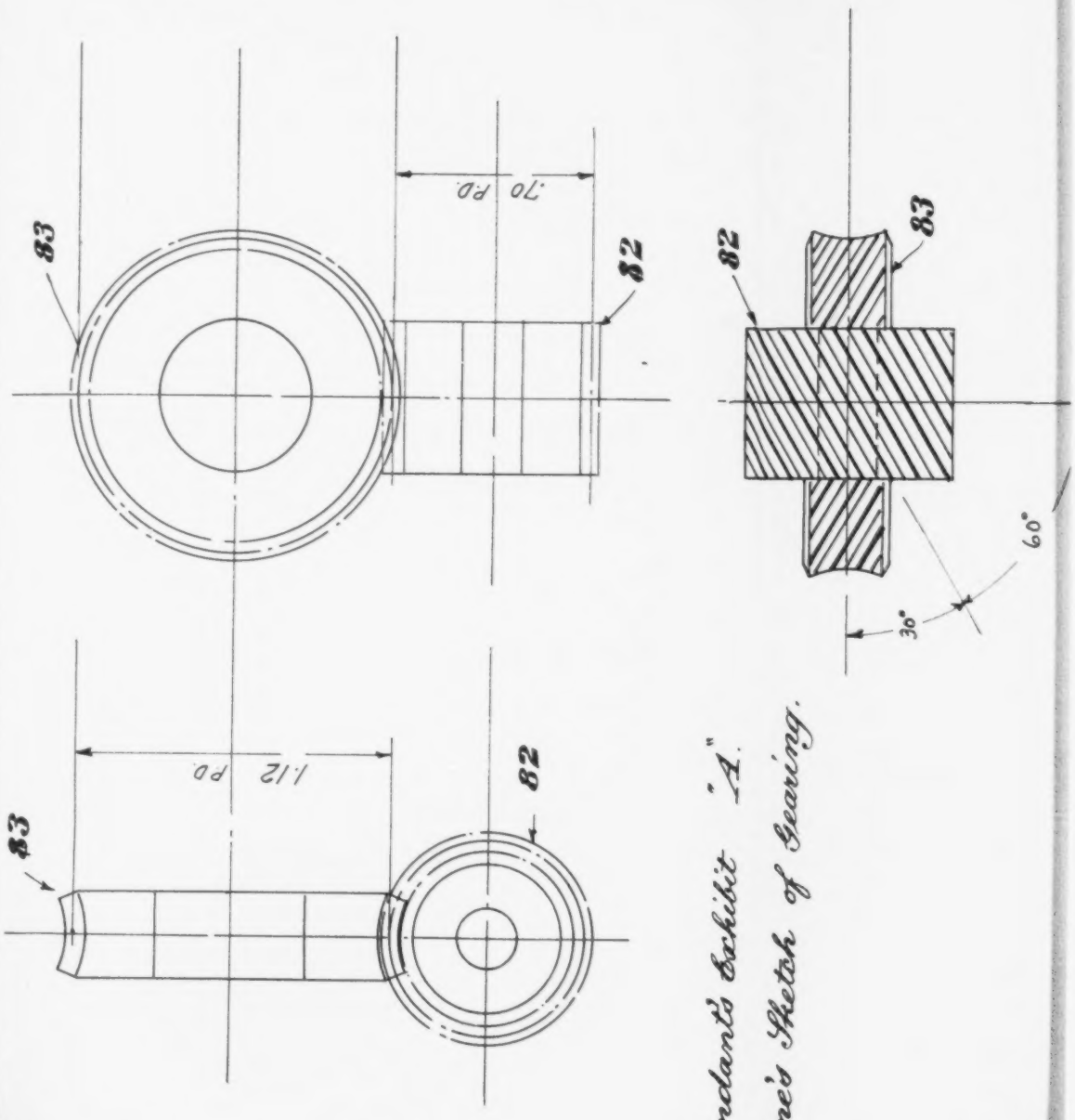
DEFENDANT'S EXHIBITS.

Gearing.



Browne's Sketch of Gearing.

Defendant's Exhibit A—Browne's Sketch of Gearing.



Defendant's Exhibit "A".
Browne's Sketch of Gearing.

Defendant's Exhibit F—Mathern Belgian Patent.

UNITED STATES CIRCUIT COURT OF APPEALS

FOR THE SIXTH CIRCUIT.

I, WILLIAM C. COCHRAN, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the foregoing is a true and correct copy of the original certification of the Belgian Patent to Mathern, No. 194,731, as filed December 5th, 1917 in the case of The Firestone Tire & Rubber Company

vs.

Frank A. Seiberling

No. 2954, and, as the same remains upon the files and records of said United States Circuit Court of Appeals for the Sixth Circuit, and of the whole thereof.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name, and affixed the seal of said Court, at the City of Cincinnati, Ohio, this 21st day of December A. D. 1917

William C. Cochran

Clerk of the United States Circuit Court of Appeals for the Sixth Circuit.

No. 7791

UNITED STATES OF AMERICA.

DEPARTMENT OF STATE.

To all to whom these presents shall come, Greeting:

I Certify That Mr E. de Cartier de Marchienne

whose name is subscribed to the paper hereto annexed, is duly accredited to this Government as Envoy Extraordinary and Minister Plenipotentiary of Belgium.

In testimony whereof I, Robert Lansing Secretary of State, have hereunto caused the Seal of the Department of State to be affixed and my name subscribed by the Chief Clerk of the said Department, at the City of Washington, this 25th day of July, 1917.

Robert Lansing
Secretary of State.

By Lewis Davis
Chief Clerk.

*FOR THE CONTENTS OF THE ANNEXED DOCUMENT THE DEPARTMENT ASSUMES NO RESPONSIBILITY.

MINISTERE
DE
L'INDUSTRIE ET DU TRAVAIL.

ADMINISTRATION
DE
L'INDUSTRIE.

Service de la Propriété industrielle.

N° 194731

Par le Gérant du Ministère de l'Industrie et du Travail, absent, Le Directeur Général, Edm. Carton de Wiart

Royaume de Belgique

BREVET D'INVENTION

LE MINISTRE DE L'INDUSTRIE ET DU TRAVAIL,

Vu la loi du 24 mai 1854;

Vu le procès-verbal dressé le 20 septembre 1901 à 12 h 55'

au Gouvernement provincial du Brabant;

ARRÊTE :

Article 1er. — *Il est délivré à M* A. Mathern,
à Bruxelles, rue Blaes, 13,
repr. par Me Hoet, à Bruxelles

un brevet d'invention

pour : Machine et procédé pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques.

Article 2. — *Ce brevet lui est délivré sans examen préalable, à ses risques et périls, sans garantie soit de la réalité, de la nouveauté ou du mérite de l'invention, soit de l'exactitude de la description, et sans préjudice du droit des tiers.*

Au présent arrêté demeurera joint un des doubles de la spécification de l'invention (mémoire descriptif et dessins) signés par l'intéressé et déposés à l'appui de sa demande de brevet.

Bruxelles, le 24 Septembre 1901.

Pour le Ministre et par délégation :
LE DIRECTEUR GÉNÉRAL,
(s.) A. Amelot.
Pour copie conforme :
Le Directeur délégué,
A. Baeteman

Imp. — Bruxelles. — 1900

COPIE CONFORME
Le Directeur délégué
GESEHEN
Im Auftrage des Generaldirektors

Coût : Arrêté : Fr :
Texte : -
Dessin : -

MEMOIRE DESCRIPTIF

déposé à l'appui d'une demande de

BREVET D'INVENTION

formée par

Monsieur Alphonse MATHERNE, Ingénieur,

13, rue Plantin à Bruxelles.

pour:

MACHINE ET PROCEDE POUR FABRIQUER MECANIQUEMENT LES ENVELOPPES POUR BANDAGES PNEUMATIQUES.

L'invention a pour objet une machine et un procédé pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques.

Le but de la machine est: de permettre la pose de toiles superposées sur un noyau leur donnant la forme et la tension rigoureusement exactes et régulières;le rognage après ou avant la pose des toiles,dans des conditions d'exactitude rigoureuse; la mise en place rigoureusement exacte des talons;l'application de la couche extérieure de caoutchouc;toutes ces opérations s'exécutant mécaniquement,avec la plus grande précision et la plus parfaite uniformité,quelles que soient les dimensions des bandages,dans tous les sens.

La machine,objet de la présente demande de brevet,est représentée au dessin annexé dans lequel:

La fig.1 est une vue en élévation,la fig.2 une vue en plan, et la fig.3 une coupe par la ligne A B de la fig.2.

Les figs. 4 à 5 montrent en élévation et en plan,l'outil à rogner les toiles.

La fig.6 représente l'outil à molette pour effectuer le déplissage.

Les figs.7,8 et 9 représentent en élévation,plan & profil respectivement l'outil pour la pose des talons.

Les figs.IO & II montrent en élévation et en coupe l'outil pour l'application des bandes de gomme.

La machine est constituée d'une manière générale comme suit:

Un bâti rectangulaire creux en fonte 1 reçoit deux montants latéraux 2.Ces montants latéraux comportent des rainelons et des glissières pour recevoir les arbres et paliers formant partie du mécanisme.

Le cône à trois vitesses 3 accolé au petit pignon 4 commande la roue 5 qui par le pignon transmet le mouvement à la roue 7 calée sur l'arbre II qui,par le pignon 8 commande la roue 9 qui actionne alors l'arbre I2 sur lequel se trouve fixé le noyau devant recevoir les toiles.Ce noyau IO tourne alors à la vitesse suffisante pour l'enroulement des toiles,la pose des talons,des bandes de gomme,etc..

Le cône 3 est fou sur son arbre mais peut en être rendu solidaire par un embrayage à griffe logé à l'intérieur.Les engrenages 5 et 6 étant montés sur un arbre I3 excentré dans ses portées,on peut les écarter à volonté au moyen de la poignée I4.Ceci étant fait et le cône étant embrayé avec son arbre,le pignon 8 calé sur celui-ci,commande alors directement l'arbre I2 par la roue 9 et on a alors pour le noyau IO la vitesse nécessaire pour déplisser les toiles sur le noyau,pour rogner ces toiles,pour moleter la carcasse finie,etc..

L'arbre I2 comporte un débrayage à griffe I5 permettant de rendre l'arbre I2 indépendant de la roue 9;l'arbre tourne alors fou et on peut faire tourner le noyau à la main dans un sens quelconque,cela pour vérifier le travail ou pour nettoyer les toiles,etc..Sur l'arbre I2 se trouve montée une pièce à coulisse I6 dans laquelle se meut dans le sens de la hauteur

un coulisseau I7 formant porte-outil et destiné à recevoir les outils nécessaires pour le travail à exécuter.

La toile s'enroule sur un tambour en bois I8 muni de guides latéraux mobiles I9 pour les différentes largeurs des toiles employées;ce tambour en bois est monté sur un arbre carré en cet endroit,mais rond sur le reste de sa longueur.Cet arbre 20 reçoit un tambour 21 sur lequel s'enroulent des lames d'acier tirées d'une part par la vis 22 et le volant 23 et maintenues d'autre part par une tension à ressort 24.

L'arbre 20 peut être avancé ou reculé à volonté selon les diamètres des bandages à confectionner.Pour cela,cet arbre est monté sur deux paliers 25 pouvant se glisser à volonté en avant et en arrière sur les coulisses ménagées dans les bâtis latéraux 2.

La pose des différentes toiles sur le noyau est assurée de la façon suivante:

L'arbre 20 supporté par deux paliers 25 montés sur les coulisses des bâtis latéraux 2,porte un tambour en bois I8 cylindrique ou bombé,sur lequel on enroule les toiles.Les deux bagues I9 montées sur ce tambour I8 assurent l'enroulement exactement en son milieu.La toile,en quittant le cylindre,passe entre deux galets sphériques ou ovoïdes,disposés de façon à produire un léger allongement sur le milieu de la toile,allongement facilitant de beaucoup le déplissage.Sur le même support il est monté de chaque côté,deux engrenages côniques 26 dont le seul but est de produire un léger plissement régulier des toiles sur leur bord,assurant à l'avance,un retrait régulier de la toile en tous ses endroits.De là,la toile est posée sur le noyau,enduit d'une couche de dissolution de caoutchouc, de façon à ce que la toile y adhère bien et soit entraînée par son mouvement de rotation.

Le tambour en bois I5 est retenu dans son mouvement de rotation par le frein métallique à lames d'acier,agissant sur le tambour en fonte 3I.En mettant en rotation le volant 23, on exerce une traction sur les lames du tambour 21;ces lames sont

retenues à leur extrémité,par un ressort 24 dont la tension est proportionnelle au serrage donné par le volant 23 sur la vis 22,cette tension étant calculée pour les efforts à exercer sur les toiles.On a pour celles-ci une résistance au déroulement parfaitement régulière et plus ou moins forte à volonté, selon les profils que l'on exécute à la machine.

La toile étant entraînée et déroulée du tambour 29,elle vient rencontrer les molettes 30 de la boîte 28.Cette boîte 28 renferme un arbre vertical coudé 33 qui actionne un coulisseau 32 guidé dans lesparois de la boîte 28.Ce coulissage 32 porte deux bielles 31 à deux articulations.Ces bielles portant chacune à leur extrémité une molette.30 qui avance et recule sur le noyau de façon à appliquer contre ses flancs droits ou bombés la toile qui vient d'y être placée.Lorsque le noyau a fait un tour complet en passant par ces molettes,on recule la boîte 28 qui s'écarte sur la glissière 34.On change alors la vitesse de la machine en emboyant le cône 3 avec l'arbre II et en écartant les engrenages 5 et 6.Sur le support I7 formant porte-outil,on monte un outil suivant la fig.6 portant une chape avec une molette à angle arrondi.on monte le coulisseau porte-outil I7 de façon que la molette arrive au niveau du dessus du noyau. On met alors la machine en mouvement et on descend la molette progressivement sur le flanc du noyau jusqu'à la base:on obtient ainsi le déplissage complet et rapide de la toile,le mouvement de descente se faisant automatiquement par l'avance ou cliquet 34.On peut aisément faire les deux côtés d'un seul coup. en montant deux outils suivant la fig.6 sur le coulisseau porte-outil I7.La toile étant ainsi posée par ces moyens,on procède de la même façon à la pose des diverses toiles sur lesquelles on applique les talons,ensuite,quand les talons sont posés, on procède à la pose des autres toiles devant recouvrir et envelopper les talons.La pose de ces autres toiles,s'effectue de la même façon,au moyen des molettes 30 et des outils à molettes suivant la fig.6.Ce dernier dispositif a le grand avantage,

étant commandé à main,de pouvoir contourner facilement les talons.On peut alors mettre dans les chapes,des molettes avec un bord arrondi plus mince,pour bien serrer et coller les toiles dans le fond des talons.

Les systèmes de commande des divers mécanismes pourront être différents de ce qui est décrit ci-dessus,mais l'invention comprend l'application à la fabrication des bandages (a) du principe des deux galets 26 et des deux engrenages latéraux préparant la toile;(b) du principe des molettes 30 avançant et reculant en appuyant sur le noyau dans le sens du rayon pour coller la toile sur ses flancs.(c) du principe de la molette descendant sur le noyau progressivement en rotation rapide,produisant le déplissement progressif de la toile,en enlevant les plis dès leur naissance,cela en un seul mouvement de descente.

Pour l'application de ces deux derniers principes,les molettes peuvent être placées en un point quelconque du noyau, l'essentiel étant que leur mouvement se fasse comme il est expliqué.

Pour la pose des talons,on emploi un jeu de deux molettes, suivant le croquis fig.7.L'âme du talon étant en A une molette principale inclinée,vient prendre le talon en dessous et une autre plus petite,formant maintient,vient se poser dessus en appuyant avec la poignée D;en mettant ensuite le bout du talon dans les deux molettes B et C,ce talon se colle sur la toile par une faible pression de la main;de plus,pour assurer une pose rigoureusement juste le jeu de molettes de cet outil comporte de chaque côté,un guide d'entrée percé de trous G ayant la forme des talons à poser et les préparant pour l'inclinaison à leur donner;on en met un de chaque côté,pour servir pour les deux côtés du noyau;mais on peut faire un jeu de molettes avec guide pour chaque côté.

Après avoir engagé le talon dans le trou du guide de derrière,les deux molettes en appuyant l'outil sur le noyau,celui-ci,par son mouvement de rotation,entraîne le talon qui passe

dans son guide,vient se placer de ce fait sous les molettes et se trouve rigoureusement et rapidement posé.

Lorsque les talons sont posés,on procède alors à la pose des toiles qui doivent recouvrir les talons;on procède alors comme il a été dit et avec les outillages décrits ci-dessus.

Après que ces dernières toiles sont posées,on procède alors au rognage de ces diverses toiles adhérentes au noyau mais irrégulières à leur base;pour cela on se sert d'un outil suivant la fig.4.Cet outil est composé d'un support A se fixant par le trou B sur le porte-outil I7,par l'intermédiaire des goujons 35,à l'extrémité de l'outil.

Sur la partie repliée d'équerre,vient se fixer un levier à main C pivotant autour d'un axe et comportant à son extrémité une lame tranchante pouvant être démontée assez facilement; on monte cet outil de façon qu'en tournant le levier,la lame vienne rencontrer le noyau;la position en hauteur,se règle aussi facilement au moyen du coulisseau I7,mobile en hauteur.

En rencontrant le noyau,la lame rencontre aussi les toiles à couper et comme ce noyau est animé d'un mouvement de rotation assez rapide,cette coupe s'effectue instantanément.

L'opération restant à effectuer,consiste dans la pose des bandes de gomme,qui se fait au moyen d'un jeu de molettes spéciales,suivant la fig.IO.Ce jeu de molettes est monté sur une plaque C maintenue par un axe vertical glissant dans une douille D fixée sur le coulisseau I7 dans son milieu.Cette disposition des molettes a pour but de coller d'abord le milieu et ensuite les côtés,pour être bien certain d'un collage parfait.L'ensemble étant appuyé sur le noyau par un ressort,la molette A prend la bande de gomme laminée et enroulée sur le tambour I8 après qu'on a enlevé le jeu de galets 26.Par le mouvement de rotation du noyau dans le sens de la flèche,la bande se pose sur le noyau;après avoir quitté la molette A,la bande est prise sur ses côtés par les molettes B qui achèvent de la coller.Le mouvement la déroule alors du tambour,pour la placer sur le noyau.

La fabrication du bandage est alors terminée et il n'y a plus qu'à le préparer pour le moulage.

R E V E N D I C A T I O N S .

1°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques,caractérisée par ce que divers engrenages et embrayages transmettent à un noyau circulaire divers mouvements de rotation appropriés aux phases de la fabrication et permettant l'emploi des dispositifs spéciaux faisant partie de la machine,en substance comme décrit et représenté au dessin annexé.

2°-Dans la machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques,comme revendiqué en 1°,un jeu d'engrenages et de galets sphériques pour produire un allongement et un retreint régulier de la toile,en facilitant le collage contre le noyau,en substance comme décrit.

3°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiquescomme revendiqué en 1°,un dispositif consistant en un ou plusieurs jeux de molettes portées par un chariot recevant par l'intermédiaire d'un levier coudé,un mouvement alternatif perpendiculaire à l'axe du noyau pour appliquer les toiles contre les flancs du noyau en substance et comme décrit.

4°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques,comme revendiqué en 1°,un porte-outil à molettes à descente progressive et automatique, dépendant de la rotation du noyau,pour effacer progressivement les plis des bandes successives de toile et pour fixer ces bandes sur les talons,en substance comme décrit et représenté au dessin annexé.

5°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques,comme décrit en 1°,un jeu de deux molettes agissant par la pression d'un levier commandé à main,pour coller les talons;un guide d'entrée approprié étant

prévu devant les molettes pour assurer une mise en place rigoureusement exacte des talons,en substance comme décrit et représenté au dessin annexé.

6°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques,comme revendiqué en 1°,un dispositif pour rogner les toiles lorsqu'elles sont mises en place,ce dispositif consistant en un levier à main,se fixant au porte-outil de la machine et portant une lame,de manière qu'une pression de la main sur le levier produise la coupe des toiles.

7°-Dans une machine pour fabriquer mécaniquement les enveloppes pour bandages pneumatiques comme revendiqué en 1°,un jeu de trois galets,sous action de ressorts,venant coller d'abord au milieu,puis sur les bords,la bande de caoutchouc qui termine l'enveloppe.

8°-Le procédé de fabrication des enveloppes pour bandages pneumatiques par l'emploi de la machine et des dispositifs revendiqués de 1° à 7°,et comportant les opérations suivantes:a) enroulement des toiles sur le noyau;après allongement et rétreint préalable; b)application de la toile contre les flancs du noyau; c) enlèvement des plis formés; d) pose des talons;e) rognage des toiles; f) collage de la bande de caoutchouc,toutes ces opérations s'effectuant mécaniquement et pendant la rotation,a différentes vitesses,du noyau annulaire.

Bruxelles,le 20 Septembre 1906.
Par procuration de Mr A. L'ATHYRUE
(s.) G. H O E L.

Translation of Belgian Patent to Mathern, No. 194731. Sept. 20, 1906.

Specification filed in support of an application for patent on an invention made by Mr. Alphonse Matherne, Engineer, 13 Rue Plantin, Brussels, for MACHINE AND PROCESS FOR MECHANICALLY MANUFACTURING CASINGS FOR PNEUMATIC TIRES.

This invention has for its subject a machine and a process for mechanically manufacturing casings for pneumatic tires.

The object of the machine is:

To enable the placing of fabric strips in super-position on a core and giving them an absolutely exact form and an absolutely uniform tension;

To enable the trimming off after or before the placing of the fabric strips under conditions of absolute exactness;

To enable the absolutely exact positioning of the beads;

To enable the application of the outer layer of rubber;

All the foregoing operations being mechanically performed, with the greatest precision and most perfect uniformity, whatever may be the dimensions of the tires in any direction.

The machine which is the subject of the present application is represented in the attached drawing in which:

Fig. 1 is a view in elevation,

Fig. 2 a plan view, and

Fig. 3 a section on line A B of Fig. 2.

Figs. 4 and 5 show, in elevation and in plan, the tool for trimming the fabric strips.

Fig. 6 represents the roller tool for removing the puckers.

Figs. 7, 8 and 9 represent in elevation, plan and profile respectively, the tool for placing the beads.

Figs. 10 and 11 show, in elevation and in section, the tool for applying the strips of rubber.

In general the machine is constructed as follows:

An open rectangular cast iron frame 1 is provided with two side members 2. These members carry projections and slides for receiving shafts and bearings, which form part of the mechanism.

A three speed cone 3 which is fast to a small pinion 4 drives the wheel 5 that transmits, through the pinion, movement to the wheel 7 keyed on the shaft 11, which latter, through the pinion 8, drives the wheel 9 which itself actuates the shaft 12 on which the core is fixed before receiving the fabric strips. The core 10 under this condition rotates at a speed sufficient for winding on the strips of fabric, placing the beads, placing the rubber strips, etc.

The cone 3 is loose on its shaft, but can be fixed thereto by a jaw clutch located within it. The gears 5 and 6 are mounted on a shaft 13, which is eccentric in its bearings, thus they may be moved aside when desired by means of the handle 14. When this is done and the cone is clutched to its shaft, the pinion 8 keyed on the latter directly drives the shaft 12 through the wheel 9, and under this condition the core 10 has the speed which is necessary for removing the puckers from the fabric strips on the core, for trimming off these fabric strips, for rolling the finished carcass, etc.

The shaft 12 carries a releasing clutch 15, which enables the shaft 12 to be disengaged from the wheel 9; under this condition the shaft rotates freely and the core may be turned by hand in either direction in order to examine the work or to clean the fabric strips, etc. Over the shaft 12 a slide support 16 is mounted, in which there is located for movement in a vertical direction a

slide 17 which constitutes a tool carrier and is designed to receive the tools which are necessary for the work to be done.

The fabric is wound up on a wooden drum 18, which is provided with movable side guides 19, for different widths of fabric employed. This wooden drum is mounted on a shaft that is squared at this point but round throughout the remainder of its length. This shaft 20 carries a drum 21, which is embraced by steel bands that are pulled at one side by the screw 22 and wheel 23 and anchored at the other side by a spring tension 24.

The shaft 20 may be advanced or withdrawn at will according to the diameters of tires to be made. For this purpose, this shaft is mounted on two bearings 25, which may be slid at will forwardly or rearwardly on slides fashioned in the side members 2.

The placing of the several fabric strips on the core is accomplished in the following manner:

The shaft 20, supported by the two bearings 25 mounted on the slides of the side members 2, carries a wooden drum 18 that is cylindrical or convex, on which drum the fabric strips are wound. The two rings 19 mounted on this drum 18 ensure the winding up exactly on the middle of the drum. The fabric, on leaving the drum, passes between two rolls that are spherical or oval in form and arranged in such a manner as to produce a slight lengthening of the middle of the fabric, which lengthening greatly facilitates the removal of the puckers. On the same support there is mounted at each side two conical gears 36, the sole purpose of which is to produce a slight uniform puckering of the fabric strips at their edges, ensuring in advance a uniform contraction of the fabric at all points. Next the fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement.

The wooden drum 18 is restrained in its rotary movement by the metallic brake consisting of the steel bands acting on the cast iron drum 21. By rotating the wheel 23, a drag is exerted on the bands of the drum 27, which bands are anchored at their ends by a spring 24 the tension of which is proportionate to the drag exerted by the wheel 23 on the screw 22, which tension is predetermined according to the pull to be exerted on the fabric strips. This provides for these latter, a tension against unrolling, which is perfectly uniform and stronger or weaker at will according to the profiles of tires being made on the machine.

As the fabric is pulled along and unwound from the drum 18 it encounters the rollers 30 on the casing 28. This casing 28 encloses a vertical bent shaft 33, which actuates a slide 32, that is guided in the walls of the casing 28. This slide 32 carries two rods 31 at two joints. Each of these rods carries at its extremity, a roller 30, which advances and retracts on the core, so as to stick to its straight or convex sides the fabric which has just been placed there. When the core has made a complete revolution, passing by these rollers, the casing 28, which moves away on the track 34, is retracted. Then the speed of the machine is changed by clutching the cone 3 to the shaft 11 and moving aside the gears 5 and 6. On the support 17, which constitutes a tool carrier, there is mounted a tool like that shown in Fig. 6, which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 is adjusted so that the roller comes to the level of the top of the core. Then the machine is set in operation and the roller is caused to descend progressively on the side of the core and all the way down to its base. Thus there is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34. Both sides may be readily worked at the same time, by

mounting two tools like that shown in Fig. 6 on the sliding tool carrier 17. After the fabric has been thus laid down by these devices, the same operation is repeated in laying down the several fabric strips on which the beads are applied; then, after the beads have been put on, the other fabric strips are laid down before covering and enclosing the beads. The laying down of these other fabric strips is accomplished in the same manner by means of the rollers 30 and the roller tools like that shown in Fig. 6. This last device has a great advantage in being manually controlled, whereby it has the capacity of easily passing over the beads. Thereafter, rollers with a narrower rounded edge may be placed in the forks in order to thoroughly press and stick the fabric strips on the bottom of the beads.

The control systems of the several mechanisms may differ from those described above, but the invention comprises the application to the manufacture of tires (*a*) of the principle of two rolls 26 and two side gears, which prepare the fabric (*b*) of the principle of rollers 30 advancing and retracting in a radial direction while bearing on the core for cementing the fabric on its sides (*c*) of the principle of the roller descending progressively on the core during rapid rotation and producing a progressive removal from the fabric of the puckers by eliminating the puckers from the point of their origin, this being performed in a single descending movement.

In carrying out these last two principles, the rollers may be placed at any desired point on the core, the essential thing being that their movement take place as explained.

For laying on the beads there is employed a set of two rollers, like the design of Fig. 7. The core of the bead being at A, a main inclined roller grips the bead below and another, smaller roller, constituting a holding means, is placed above by pressing with the handle D.

When the end of the bead is then placed between the two rollers B and C, the bead may be stuck on the fabric by a light pressure of the hand; further, in order to ensure an exactly accurate placement, the set of rollers of this tool has, at each side, an entrance guide provided with holes G, which have the shape of the beads to be laid on and which prepare them for the angle at which they are to be set. One of these may be used for both sides in order to operate on two sides of the core; but a set of rollers with guide may be provided for each side.

After inserting the bead in the guide hole from the rear, the two rollers are pressed by the tool against the core, and the latter, by its rotary movement, draws along the bead which passes through its guide and thereby is caused to pass under the rollers and be accurately and rapidly laid on.

After the beads have been placed, the next proceeding is to lay on the fabric strips which are to cover the beads; this step being carried out as has been described and with the tools described above.

After these last fabric strips have been laid on, the next proceeding is to trim off the fabric strips which are adhering to the core, but are irregular at their edges. In order to accomplish this, use is made of a tool like that shown in Fig. 4. This tool consists of a support A which is secured by a hole B to the tool carrier 17, through the employment of the pins 35, at the extremity of the tool.

On the right angle part, there is fixed a hand lever C, which pivots about an axis and carries at its end a cutting blade, which is readily removable. This tool is mounted in such a manner that by turning the lever, the blade will contact with the core; and its position as to height may be easily adjusted by means of the slide 17 that is vertically movable.

When it contacts with the core, the blade also contacts with the fabric strips to be cut and, as the core is

rotated at a sufficiently high speed, this cutting operation is instantly effected.

The operation which remains to be performed consists in the laying on of the strips of rubber, which is performed by means of a set of special rollers, as shown in Fig. 10. This set of rollers is mounted on a plate C, which is supported by a vertical axis which slides in a sleeve D, secured to the slide 17 at its center. This arrangement of rollers is designed to first stick the center and then the sides, in order to make sure that there is a perfect adherence. This device is pressed on the core by a spring and the roller A grips the rubber band which is flattened and wound up on the drum 18 after the set of rolls 26 have been removed. As a result of the rotary movement of the core in the direction of the arrow, the rubber band is laid on the core; and, after leaving the roller A, the band is seized at its sides by the rollers B, which operate to stick it down. The movement of the core unrolls the band from the drum in order to place it on the core.

The manufacture of the tire is then finished and all that remains to be done is to prepare it for molding.

CLAIMS

1. In a machine for mechanically manufacturing casings for pneumatic tires, characterized by the fact that several gears and clutches impart to an annular core various rotary motions appropriate to the phases of the manufacture and enable the employment of special devises constituting part of the machine, substantially as described and shown in the annexed drawing.

2. In the machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a set of gears and of spherical rollers for producing a uniform lengthening and convexing of the fabric, thereby facili-

tating the sticking of it to the core, substantially as described.

3. In a machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a device consisting of one or more sets of rollers carried by a carriage which receives, through a bent shaft, a reciprocating movement perpendicular to the axis of the core in order to stick the fabric on the sides of the core, substantially as described.

4. In a machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a tool carrier having rollers and arranged to move downward automatically and progressively, dependent on the rotation of the core, in order to progressively efface the puckers of the successive strips of fabric and to apply these strips on the beads, substantially as described and shown in the annexed drawing.

5. In a machine for mechanically manufacturing casings for pneumatic tires, as described in claim 1, a set of two rollers acting under the pressure of a hand lever, for sticking on the beads; a suitable entrance guide being provided in advance of the rollers for ensuring an absolutely exact laying on of the beads, substantially as described and shown in the annexed drawing.

6. In a machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a device for trimming the fabric strips after they have been set in place, this device consisting of a hand lever fixed on the tool carrier of the machine and having a blade, so that manual pressure on the lever will cause the fabric strips to be cut.

7. In a machine for mechanically manufacturing casings for pneumatic tires, as claimed in claim 1, a set of three spring actuated rollers, which first stick down the center and then the edges of the rubber band which completes the tire.

8. The process of manufacturing casings for pneumatic tires by the use of the machine and its devices claimed in claims 1 to 7, and comprising the following operations:

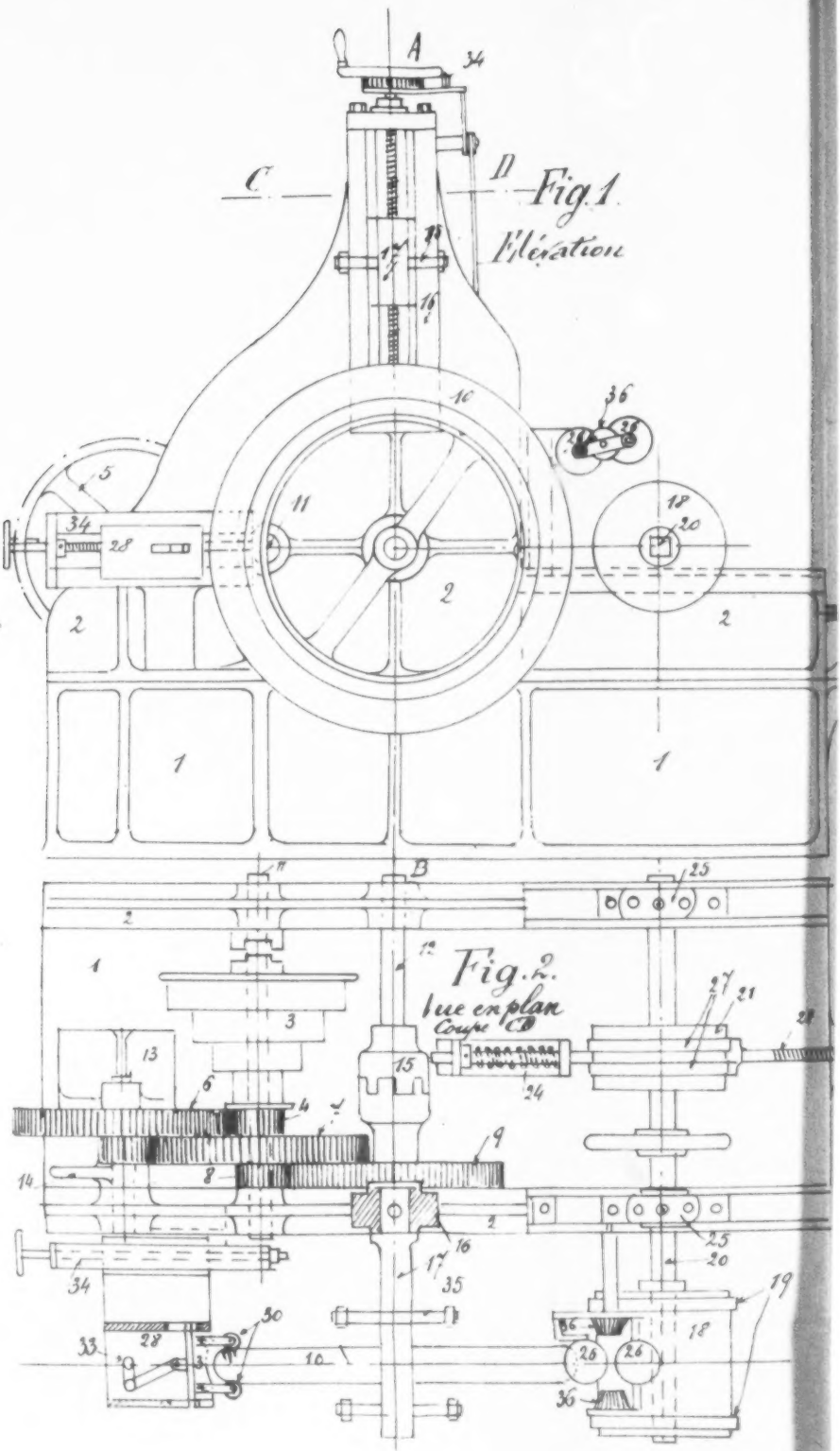
(*a*) winding the fabric strips on the core, after a preliminary lengthening and convexing; (*b*) sticking the fabric on the sides of the core; (*c*) eliminating the puckers formed; (*d*) laying on the beads; (*e*) trimming the fabric strips; (*f*) sticking on the rubber strip, all these operations being performed mechanically and during the rotation, at different speeds, of the annular core.

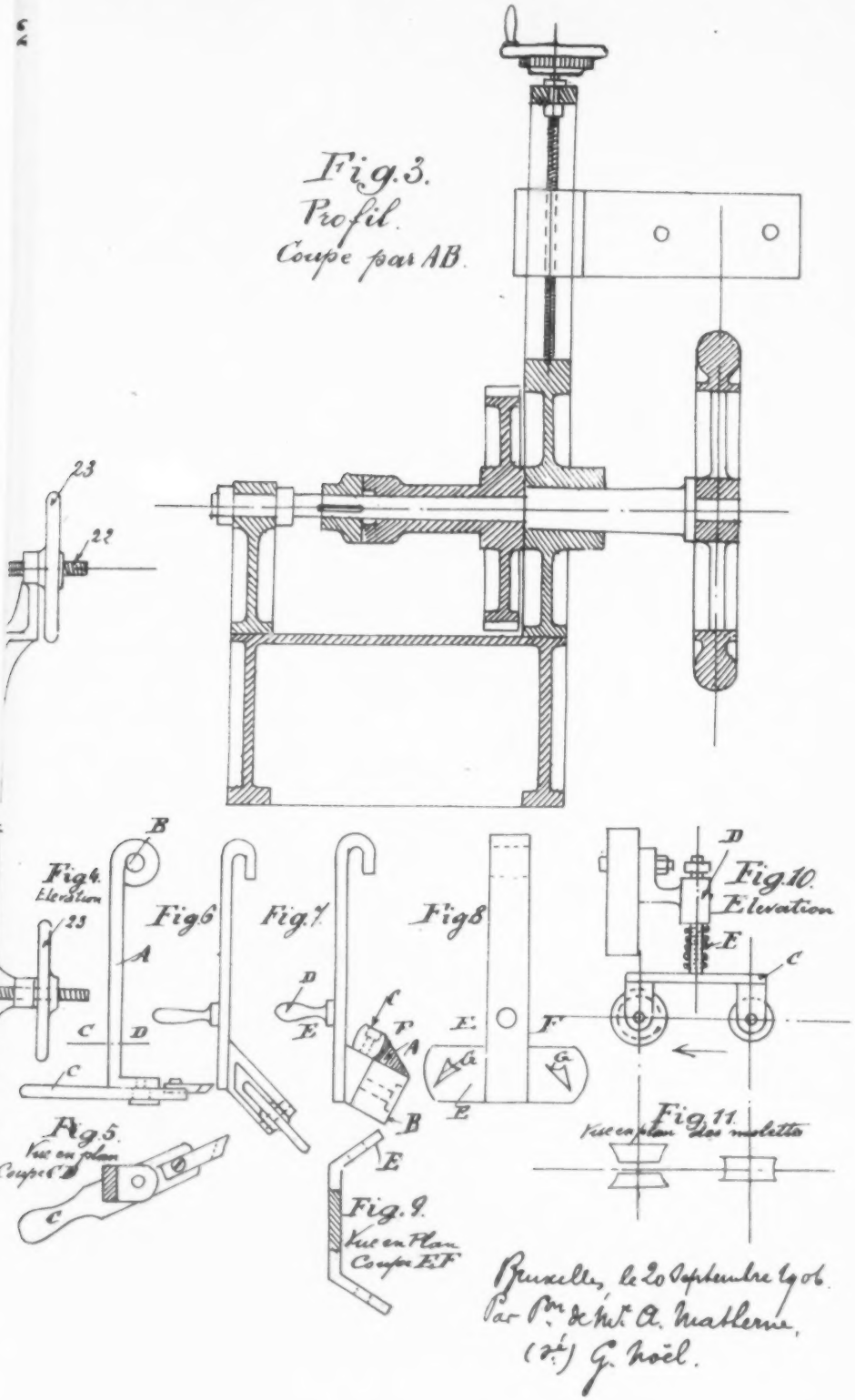
Brussels,

September 20, 1906.

Through the application of Mr. A. Matherne.

(s) G. NOEL.


A
C
D
Fig. 1
Élévation
B
Fig. 2
Vue en plan
Coupe CD


Fig. 3.
Profil.
Coupe par AB.
23
22
Fig 4.
Elevation
23
A
C
D
C
B
Fig 6
Fig 7
D
E
f
F
A
B
E
Fig 8
E
F
G
G
E
Fig 5.
Vue en plan
Coupe CD
C
Fig 9.
Vue en Plan
Coupe EF
D
Fig 10.
Elevation
E
C
Fig 11
Vue en plan des molette
Bruxelles, le 20 Septembre 1906.
Par Pon de Mr A. Mathieu,
(Sgd) G. Noël.

[Second Edition.]

N° 25,588 A.D. 1909

Date of Application, 5th Nov., 1909—Accepted, 28th Apr., 1910

COMPLETE SPECIFICATION.

Machine for Making Open-bellied Pneumatic Tyre-shoes.

I, WILL CHARLES STATE, Corner of College and East Market Streets, Akron, Ohio, United States of America, Mechanical Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to a machine for the manufacture, from flat sheets of rubber-coated canvas of the open-bellied casings or more briefly the open casings of tire-shoes which are used in connection with an inflatable inner rubber tube to constitute the double-tube pneumatic tires now used on automobiles and the like.

My machine comprises a power-driven ring-core in connection with a pair of stock-rollers which have wound thereon strips of sheeted canvas skim-coated with rubber and cut on the bias. By this means I am enabled to supply a round of canvas on the ring-core from the roll and then a second round of canvas on the ring-core from the other roll. By properly arranging the rolls with respect to each other, the superposed layers of canvas on the ring-core will have their threads crossed, as is necessary in building strong tires. The pair of stock-rollers may be mounted one above the other, or side by side on a sliding or rotary table so that the stock can readily be drawn therefrom to the power-driven ring-core in alternation. This combination in an open tire-shoe making machine of a power-driven ring-core with a pair of stock-rolls from which alternate layers of crossed fabric may be supplied to the ring-core is an important feature of my invention.

A layer of canvas having been applied to the ring-core, a radially movable smoothing or tread-forming roll firmly shapes and presses the canvas against the ring-core near its external periphery to form the parts of the tire which lie under its tread portion. Thereupon a pair of spinning-rolls gradually press the canvas in contact with the sides of the ring-core toward its internal periphery to shape the sides of the tire. These spinning-rolls are spring-pressed and their outer periphery or working edge is disc-shaped and rounded so as not to cut the fabric. The spinning-rolls are also radially movable with reference to the ring-core. They have been found peculiarly efficient in shaping the sides of the tire-shoe and form an important feature of my invention. They are sharply differentiated from the hammers or sliding finger devices heretofore proposed for the purpose. So, too, the combination of the tread-forming roll for operating upon the tread portion and the spring-pressed spinning-rolls for shaping the sides of the tire-shoe forms an effective instrumentality for completely shaping the tire and an important feature of my invention.

In order to prevent the several spiral layers of canvas, which are skim-coated or saturated with rubber, from sticking together while on the stock-roller, I place a strip of plain muslin or the like against the rubber-coated canvas and wind this combination upon the stock-roll. It becomes important, then, when the rubber-coated canvas is drawn onto the ring-core from the stock-roll that provision be made for disposing of the muslin which is unwrapped at the same time. To this end I apply as another feature of my invention a take-up roll for the muslin which is driven by frictional contact against the outer surface of the stock-roll.

[*Price* 8*d*.]

It is important to secure proper tension on the fabric as this is drawn from the stock-roll onto the ring-core. To this end I cause the fabric to pass over a rubber-covered roll to which some form of tension brake is applied. I have found, also, that the fabric in passing under tension from the stock-roll to the ring-core forms longitudinal creases. These I remove by a stretching-roll supplied with a pair of divergent spirals on its surface.

Without unduly extending this preliminary outline of my invention, I may say that an important feature of my machine results from the fact that I apply the canvas to the power-driven ring-core while this is moving quite slowly, say at six revolutions a minute. I have discovered, however, that it is not only possible but highly desirable to let the smoothing- and spinning-rolls operate upon the ring-core while this is moving at a much higher speed, say at two hundred and seven turns a minute. By this means the machine not only does more work in a given time but does better work.

I shall now describe, in detail, the machine which constitutes the best embodiment of my invention now known to me.

In the drawings,—

Figure 1 is a plan of my device;

Figure 2 is a view in side elevation looking from the right of Figure 1 with portions in section to illustrate the internal construction thereof;

Figure 3 is a sectional view of the mechanism for supporting and rotating the core on line X of Figure 4;

Figure 4 is a sectional view of the mechanism shown in Figure 3 on line Y thereof;

Figure 5 is a view in side elevation of the mechanism for communicating motion to the mechanism shown in Figures 3 and 4;

Figure 6 is a view in end elevation of the support and tool carriage on which the devices used for manipulating, shaping and smoothing the fabric while being placed on the core are mounted;

Figure 7 is a view in side elevation of a tension regulating device;

Figure 8 is a view, in central section, of a lock employed in this device;

Figure 9 is a plan of a turret on which the mechanisms for manipulating the tire are mounted, also showing the various tools employed in connection with this type of device on a ring-core shaped for clincher tires;

Figure 10 is a sectional view of a standard and reel on which a supply of rubber-coated fabric is mounted;

Figure 11 is a view partly in elevation and partly in section of a chuck on which the core is mounted while the tire is being formed thereon;

Figures 12, 12^a, 12^b, 12^c are cross-sections of a ring-core for inextensible-edge tires with the fabric in different stages of application;

Figure 13 is a diagram of a ring-core used alternately in connection with a pair of stock-rolls on a sliding support; and

Figure 14 is a diagram of a pair of superposed stock-rolls used alternately in connection with a ring-core.

Referring to the drawings in detail, 1 is the base carrying a cylindrically-formed member 3 upon which loosely turns the rotary head 8 by means of a ball-bearing connection 5. The head 8 is provided with a series of pairs of lugs 13, the space between each pair forming a recess to receive a locking member 14 mounted on the side of the cylinder 3 for arresting at predetermined intervals the movement of the head. Extending upwardly from the head 8, as seen in Figure 1, are two varieties of standards 15, 16. The four standards are L-shaped in cross-section and are positioned with the angles or corners thereof inwardly towards the axis of the cylinder 3. Mounted on these standards 15 and 16 are four complete sets of rolls, and as these sets of rolls are similar, a description of one will be sufficient. Each set of rolls comprises a stock-roll, a take-up roll, an idle roll, a rubber-covered tension-roll and a stretching-roll which will now be described.

Extending laterally from the standard 15 is an integral arm 24, shown best in Figure 10, from the outer end of which projects a stub shaft 25 provided with a spring catch 26 for holding a stock-roller 27 on which the supply of rubber-saturated fabric 28 is wound, the successive layers of which are prevented from sticking together by interposing between them a strip of muslin or cloth 29. By releasing the catch 26, the roller 27 may be removed from its shaft 25 and replaced by another roller on which a fresh supply of fabric and cloth is wound whenever the supply on the original roller becomes exhausted.

Mounted on the shelf 17 (Figures 1 and 2), which extends horizontally across the upper corner or angle of the standards 15, is an upright hanger 18 having a laterally extending arm 19 to the free end of which is pivotally mounted a depending yoke 20 which has mounted on pins in its free ends thereof a roller 23, hereinafter designated as the take-up roller.

Below the arm 24 is an idle roller 30 (see Figure 2) mounted between the standards 15 and 16.

In the front or outer portion of the standards 15, 16 are bearings to receive a shaft on which is mounted a tension roller 36, preferably having its outer face covered with a layer of vulcanized rubber 361, which rubber-coating I have found peculiarly efficient. The tension-roll constitutes a highly important element since it secures the application of the several layers of fabric to the ring-core with a uniform degree of tension. To this end there is mounted on one end of the shaft which bears the tension-roller 36 (Figure 2) a disc 42 (Figures 2 and 7) around which a friction band 43 having one end anchored to a post 44 on one of the standards and having its other end connected to a rod 45 bearing a tension measuring gauge 46 and a turnbuckle 47 at its lower end. The turnbuckle 47 is connected with some fixed support such as the base 8 by means of a second rod 48. If increased tension is desired on the tension-roller 36 the turnbuckle 47 is manipulated so as to cause a contraction of the friction band 43 on the disc 42 to a determined degree, indicated by the gauge 46, so that a predetermined amount of resistance will be offered to the turning or movement of the tension-roller 36.

I have found that as the ring-core draws the fabric under tension from the stock-rolls, the fabric forms troublesome longitudinal creases which must be got rid of. The expedient which I have finally hit upon for this purpose consists of a stretching-roll 41, here shown as mounted in a swinging frame 40. The outer surface of the stretching-roller 41 is provided with two spirally arranged sets of grooves both commencing at the longitudinal central line thereof and diverging spirally therefrom to cause it to laterally stretch and smooth the rubber-saturated fabric which is drawn partly around it in its passage from the tension-roller, the effect of the roller being to remove all longitudinal creases and other wrinkles which will be formed in the fabric during the removal of the stock from the stock-roller on its passage to the ring-core. The arms 40 are permitted to swing on bolts and are held in any determined position by tightening nuts. By passing the fabric over the tension-roll and under the stretching-roll, the fabric is in contact with the surfaces of these rolls for a considerable fraction of the circumference.

It will be understood that the stock-roll, the idle-roll, the tension-roll and the stretching-roll constitute a single set of rolls, there being, in the case shown, four sets or two pairs of sets of rolls in all, one pair of set of rolls cooperating with one ring-core and the other pair of set of rolls cooperating with the other ring-core. Considering the pair of stock-rolls which cooperate with a single ring-core, it is understood that the rubber-coated canvas is applied to the two stock-rolls in such a manner that when they cooperate with the ring-core the threads of the fabric from one roll will be at an angle with the direction of the threads of the fabric from the other roll. This is brought about, in the construction which has just been described, by mounting a pair of sets of stock-rolls upon the rotary head 8. But the same result could be obtained among numerous other

ways by mounting a pair of stock-rolls upon a sliding head, as shown in Figure 13, or by mounting the stock-rolls one above the other, as shown in Figure 14 and placing the stock upon the pairs of stock-rolls so that their threads will come at angles to each other when supplied to the ring-core.

The operation of a set of rolls is as follows: In order that the ring-core may take hold of the fabric, the core is coated with rubber or cement. The rubber-coated canvas is now unwound from the stock-roll and carried downwardly under the idle roll 30, and from thence upwardly around the tension-roll 36, and from thence downwardly under and around the stretching-roll 41, and finally onto the power-driven ring-core to which the end of the canvas is made to adhere. Since the ring-core is power-driven at a low speed, the rubber-coated canvas will be drawn outwardly from under the surface of the stretching-roll as well as over the surface of the tension-roll. In this manner the fabric will be smoothed by the stretching-roll and the proper tension will be applied to it by the tension-roll. When one round of canvas has been applied to the ring-core, the length is cut off by the workman's scissors from the portion remaining on the stock-roll. The cloth which is interposed between the layers of the rubber-coated canvas on the stock-roll passes downwardly around the under face of the stock-roll and from thence upwardly and is then rewound on the take-up roll 23 which, being hung between the arms of the pivoted yoke 20, frictionally rests on the surface of the stock-roll 27, thus receiving motion thereby.

During the operation of withdrawing the strip of rubber-coated canvas from the stock-roll, the lug 14 (Figure 2) will be inserted in the recess between the lugs 13 to prevent the revolution of the head 8.

I have now to describe the source of power for the ring-core. Mounted on the base 1 is a motor 49 having a sprocket wheel 50 driving a sprocket chain 51, passing around a sprocket wheel 52, on a shaft 53, supported by brackets 54. The shaft 53 carries at its ends, sprocket wheels 55 driving sprocket chains 56, passing around the loose members of clutches 57, which with their cooperating tight members 59 are mounted on shafts 58 (Figures 3, 4, 5) and are operated by clutch levers 59^1.

Mounted on suitable ways 60 at each end of the base 1 are housings 61. Each of these housings may be provided on its under surface with suitable grooves so as to render them movable on the ways 60 and is held in a determined position by means of bolts 62, the lower ends of which engage in slots 63 formed in the base 1. The housing 61 is hollow and is provided with an opening through which the shaft 58 enters (Figure 4). Within the housing are a pair of aligned brackets provided with bearings bolted to the walls of the housing and supporting one end of the shaft 58. Extending longitudinally of the housing 61 and supported in bearings suitably secured to inturned flanges 69 formed integral with the body of the housing is a shaft 70 near the longitudinal centre of which is splined a clutch member 71 having its two lateral faces formed to engage corresponding clutch members 72 and 73 mounted loosely on said shaft 70. The clutch member 72 is provided with a hub 74 rigidly secured to a spiral gear 75 adapted to be driven by means of a worm 76 mounted on the shaft 58 just as the corresponding clutch member 73 has a hub 84 secured to a spiral pinion 83 driven by a worm 82 on a shaft 78. The shaft 78 is driven from the shaft 58 by a chain and sprocket connection and the arrangement is such that the spiral gear 83 rotates more slowly than the spiral gear 75.

It will thus be seen that the shafts 58 and 78 are power-driven and rotating when the clutch members 57 and 59 are engaged. With them rotate the clutch-members 72 and 73, which are loose on the shaft 70. By throwing the clutch member 71, which is splined on the shaft 70, into connection with either the clutch members 73 or 72, the shaft 70 is made to revolve slowly or rapidly. The movement of the clutch member 71 is effected by the shifting lever 86.

Mounted on the shaft 70 outside of the housing 61 is a gear 88 (Figure 5) adapted to mesh with a pinion 89 secured to the extended end of a shaft 90.

mounted in the upper part of the housing 6ll and carrying a locking-disc 93. Cooperating therewith is a spring pressed locking-pin 100 held out of engagement with the locking-disc by a cross-pin 97 moving in a slot in the casing 95 (Figure 3). To lock the shaft 90 in a fixed position, the pin 100 is allowed to assume the position shown in Figure 3. To permit the shaft 90 to rotate, the pin 100 is withdrawn from contact with the locking-disc 93 and held in this withdrawn position by the cross-pin 97, which bears against the end of the casing 95, all in a manner readily understood.

I have now to describe the chuck for carrying the ring-core. Mounted on the shaft 90 is a chuck (see Figure 11) comprising a cup-shaped body portion 101 provided with an internally threaded hub 102 to receive the end of the shaft 90. The interior of the member 101 is further provided with a flange 103 provided with openings 104 in radial alignment with similar openings 105 in the outer face of the chuck. Positioned in these openings 104 and 105 are exteriorly threaded shafts 106 carrying between the flange 103 and the outer wall of the chuck, nuts 107 the exterior faces of which are formed with beveled gear teeth. Secured to the outer wall of the chuck by means of screws 108 is an annular flange or ring 109 extending inwardly from the outer wall of the cup-shaped member a short distance. Mounted in the space enclosed by the ring 109 is a disc 110 provided with a central opening 111 and with a plurality of openings 112 disposed in a circle concentric with the opening 111. The outer edge of the disc 110 is provided with a shoulder to receive the ring 109 for positioning and holding the disc in place. The inner face of the disc is provided with gear teeth adapted to intermesh with the teeth on the nuts 107. Mounted in the flange 103 are keys 113 arranged to enter key-ways 114 cut longitudinally of the shafts 106 for locking them against rotation in unison with the nuts 107. The outer ends of the shafts 106 are preferably beveled to form a sharp edge for a purpose to be hereinafter described. This chuck is adapted to temporarily hold the ring-core on which the tire casing is to be built. The ring-core (Figure 2) is provided with an inwardly-extending flange 116 having at intervals V-shaped slots 117 to receive the outer ends of shafts 106.

While I have described the mechanism for driving and supporting the ring-core in detail, so that its exact construction may be understood, it will be seen that in its essence I employ a slow-speed mechanism, in this case represented by the clutch member 73, and a fast-speed mechanism, here represented by the clutch member 72, and a speed-changing mechanism, here represented by the clutch member 71 and its shifting lever 86. But when I use the terms fast-speed mechanism, slow-speed mechanism and speed-changing mechanism in the claims, it is understood I mean any class of mechanism accomplishing these functions and not merely the specific mechanism herein shown. Power is thus transmitted from the shafts on which are mounted sprocket wheels 50 and 52, and shaft 58 (Figure 5) to the shaft 70 (Figure 4), and in turn to the shaft 90 which, by means of a suitable chuck, carries the ring-core. To mount the ring-core on the chuck, the shifting lever 86 is placed in its intermediate position with the clutch member 71 out of contact with either the fast- or slow-speed mechanism. The locking-stem 100 is now permitted to come into engagement with the locking-disc 93 to hold the shaft 90, which carries the chuck, in an immovable position. This permits the ring-core to be readily placed on the chuck. Thereupon the locking-stem 100 is withdrawn from engagement with the locking-disc 93 and the speed-shifting lever 86 is operated to throw the slow-speed mechanism into action. The ring-core is now rotated at a slow speed. At this time a single layer of rubber-coated fabric is drawn onto the ring-core from the stock-roll. The shifting-lever is now quickly actuated to stop rotation of the core. Thereupon a pair of scissors in the hand of the operator separates the strip of rubber-coated canvas, which is around the core, from the canvas wound on the stock-roll. The speed-changing mechanism is now again actuated to bring the fast-speed mechanism into action. Thereupon

the tread-forming and spinning-rolls are brought into play. The supports for these I now proceed to describe.

Slidably mounted on the base 1, substantially below the position occupied by the chuck just described, is a standard 118 comprising a hollow metallic box having outlines approximately concentric with the shaft 90 provided with a depending lug 119 in its lower portion through which extends a screw 120, manipulated by a hand-wheel 121 for shifting the standard 118 towards and away from the ring-core 115, thereby making it possible to position and adjust it with respect to the latter when different sized cores are used. The upper portion of the standard 118 is provided with an outwardly-extending dovetailed portion 122 (Figure 6) on which is slidably mounted a carriage 123 provided with a depending lug, indicated in dotted lines in Figure 2, similar to the lug 119, adapted to receive a screw controlled by a hand-wheel 124 for shifting it toward and away from the core.

In the side of the standard 118 immediately below the carriage 123 is a pivoted arm 125 provided with a pin 126 adapted to enter a hole 127 in the side of the standard 118. Depending from the side of the carriage 123 is a lug 128 provided with a pin 129 threaded to permit its adjustment in the lug 128. When the arm 125 is swung upwardly so that the pin 126 is positioned in the hole 127 the pin 129 will engage the arm 125 and arrest further inward motion of the carriage thereby constituting an adjustable stop for accurately limiting the movement of the carriage with respect to the core. The carriage 123 bears an upwardly-extending centrally-placed pin 130 on which is mounted a revoluble head or turret 131 held from displacement by a nut 132. Reference is here directed to Figure 9. The turret 131 bears a lock 133 (indicated in Figure 1) exactly similar to the lock shown in Figure 8, provided with a vertically-shiftable stem the lower end of which is adapted to enter suitable openings 134 in the upper face of the carriage 123, and lock the turret in determinate positions.

The revolving head or turret 131, which is shown simply as a sample of one type of transversely movable support I may employ, bears what for lack of a more suitable name I call the tread-forming-roll 141, the spinning-rolls 147, the cutters 149 and the bead-attaching rolls 156, which can be alternately brought into play because of the rotary or transverse movement of the head 131 with respect to the ring-core. These instrumentalities may be juxtaposed to the ring-core, one after the other, by rotating the head. Since the supporting head 131 is radially movable with reference to the ring-core by means of the hand-wheel 124, it follows that each of the instrumentalities mounted thereon is radially movable with respect to the ring-core. In the case of the tread-forming-roll 141, this permits the operator to gradually bring the proper amount of pressure to bear on the canvas either which lies under or which actually forms the tire tread to thoroughly smooth it and shape it to the core. In case of the spinning-rolls 147, the radially movable support permits the operator to pass the rolls gradually over the surface of the side of the ring-core from the edge of the tread portion to the tire-edge, so as to gradually bring the canvas which is to form the rubber tire into contact with the sides of the ring-core. In case of the pivoted cutters 149 as well as in the case of the bead-applying roll 156, the radial movability of the support renders it possible to position the parts to the proper place for the work intended with different sized ring-cores.

The tread-forming-roll is mounted in brackets on the radially and transversely movable head 131. Its axis, when in operation, is parallel to the axis of the ring-core and its curvilinear shape in longitudinal section is made to correspond to the shape of the outer or tread portion of the ring-core. It will thus be clear that after the operator has drawn a layer of rubber-coated canvas onto the ring-core, he can, by pressing the tread-forming-roll 141 against the fabric, smooth and shape the fabric on the core and get it free of captured air bubbles

or wrinkles over its outer face. This action will be all the more efficient by reason of revolving the ring-core at high speed.

The spinning-rolls 147 are preferably mounted on ball-bearings or similar anti-friction mechanism for they revolve at high speed and exert considerable pressure on the fabric. They are laterally movable, that is to say they are movable toward and away from the plane of the ring-core and this movability I effect, in the case shown, by pivoting them at 146 on arms 144 mounted on pivots 143 on the head 131. A pair of grips or hand holds 142 on the arms 144 enables the operator to force the rolls 147 apart both when they are first applied to the ring-core and when they are withdrawn therefrom, in the backward motion, after their work is finished. The spinning-rolls are also spring-pressed toward the plane of the ring-core by springs 145, here shown, diagrammatically, as leaf springs although, in practice, strong spiral springs will be used. These springs exert the pressure against the fabric for forming it against the sides of the core which would be exerted by the arm of the workman in case of a hand-tool. In consequence the work of these spring-pressed spinning-rolls is far more even and more rapid than in the case of a hand operated roll. And it is of course understood that there may be substituted for the springs the more cumbersome device of a weight constantly tending to force the spinning-rolls, with considerable pressure, toward the ring-core. While I have shown these spinning-rolls as disc-shaped throughout, it will naturally be understood that the disc-like or narrow character of the rolls is only essential at the periphery which is rounded and not sharp so as not to cut the fabric. By having the outer or working edge of the spinning-roll of a narrow or disc-shape or bead form, it follows that this working edge can effectually contact with the fabric at all portions along the sides of the ring-core. This would be impossible with a roller of the type shown at 141. On the other hand, the spinning-rolls are not so well adapted as the rolls 141 to shape the tread portion of the tire. It will be noted finally that I mount the spinning-rolls with their plane not at a right angle to but to recede at an acute angle from the plane of the ring-core. The fact is when the ring-core is rotating at high speed, the centrifugal force tends to throw the fabric out at a right angle from the core-plane and unless the roller recedes in the manner shown, the fabric will become entangled with it. Besides the spinning-rolls, when mounted in this way, are found to have a better forming action on the fabric.

The action of the pivoted cutters 149 will be understood without much description. They are brought into position by turning the head 131 and forced together at the proper time to trim the edges of the fabric which has been applied to the ring-core.

The bead-applying rolls 156, 158 are mounted on the arms 155 which swing on the arms 154. The ordinary bead, such as is used in forming a clincher tire, being put into place on one or more layers of fabric which have already been applied to the ring-core, the rolls 156, 158 are swung into place and press the bead firmly into position as the ring-core rotates.

I have shown in Figure 9 the type of ring-core which will be used for clincher tires. But clearly, my machine can also be used to make tire-shoes of the inextensible-edge type. To this end I use a collapsible ring-core, the shape of which in cross-section is shown in Figures 12, 12^a, 12^b and 12^c. The fabric in the several stages of application is also shown in these several figures. The ring-core has two lateral grooves which furnish lodgment for the heavy inextensible edge which is employed in this class of tires. It will be understood that one or more layers of fabric are applied to the ring-core, that the inextensible edges are then placed into the lateral grooves by hand and that the outer layers or plies of fabric are finally applied over the inextensible edge. In this case the pivoted cutter 149 may be replaced by a knife in the hands of the workman, since the edge of the lateral groove will act as a guide and that

the bead-applying rolls 156, 158 are dispensed with. The tread-forming-rolls 141 and the spinning-rolls 147 are alone used.

Before describing the operation of the device, attention is directed to the fact that the machine is so constructed that there are two cores on which separate workmen can simultaneously work and place fabric, these being placed diametrically opposite to each other, as shown in Figure 1, and each core is provided with its appropriate mechanism all driven from the same source of power.

The operation of my invention will now be reasonably clear. As I have before explained, a ring-core supplied with some adhesive material on its exterior portion is placed upon the chuck while the speed-shifting lever is in position to hold the speed-mechanism out of action. Thereupon, by properly rotating and locking the rotary support for the stock-rollers, a given stock-roll is brought opposite to the ring-core and the end of the fabric thereon is pasted against the ring-core. The slow-speed mechanism being now brought into action, the ring-core slowly rotates, making a single turn in about ten seconds, drawing the rubber-coated fabric from off the stock-roll and around the tension and stretching-rolls. It results that one round of fabric is now applied under uniform tension to the ring-core. Thereupon the speed gear is put out of action, the ring-core stops moving, and the operator cuts the rubber-coated fabric across to separate the round of fabric which is on the ring-core from the fabric which yet remains on the stock-roll.

The fast-speed mechanism is now brought into play. The tread-forming-roll 141 is then brought into action to shape and smooth the tread-portion of the fabric against the outer periphery of the ring-core. The proper pressure is applied to the tread-forming-roll 141 by the devices which make it radially movable, that is by the hand-wheel 124 which radially moves the carriage 131. The parts of the tire which will ultimately lie under the tread having been shaped and the fast-speed gears still being kept in action, the carriage 131 is rotated to juxtapose the spring pressed spinning-roll 147 to the ring-core. The operator forces these rolls apart against the action of the springs. At first the spinning-rolls are positioned to act upon the edges of the tread portion of the tire-shoe. But they are gradually moved radially by the operator by operating the hand-wheel 124 so that they pass over the side portions of the tire-shoe as illustrated in Figures 12^b, 12^c and Figure 9. Thus the entire tire-shoe is gradually shaped to the ring-core. The operator now forces the spinning-rolls apart and operates the wheel 124 in the reverse direction to withdraw them from reach of the ring-core but without touching the fabric in this reverse motion.

A single layer of canvas having been applied to and smoothed and shaped upon the ring-core, it will be obvious that the operator will bring the slow-speed mechanism into action, that he will now take his rubber-coated fabric from a second stock-roll and will apply this upon the layer of fabric already on the ring-core in precisely the same way as the first layer of fabric was applied to the ring-core itself. But, by the provision of the two stock-rolls having the rubber-coated canvas thereon constituted of strips cut on the bias, it will be plain that it will be easy to arrange matters so as to have the threads of the canvas layer first applied at an angle to the threads of the canvas layer next applied. This is necessary to make the best type of tire. Two or more layers of canvas having been applied, the cutter may be brought into action to trim the edges of the tire. Thereupon the bead is put in place and the bead-applying rolls are brought into action. Finally, several more layers of fabric with their threads crossed are applied to the ring-core, precisely as in the case of the layers originally applied.

I may say in conclusion that whereas an operator can make four or five tires a day by hand, he can make from forty to sixty a day by my machine and make them better than they can be made by hand.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a machine for making open-bellied pneumatic tire-shoes, the power-driven ring-core and the pair of stock-rolls from which, in alternation, successive layers of fabric, with their threads crossed, are supplied to the core.

2. In a machine for the same purpose, the power-driven ring-core and the radially-movable, spinning-rollers laterally spring-pressed against and rotated by the core, having a disc-like periphery which shapes the fabric to the sides of the core in its radial movement.

3. In a machine for the same purpose, the power-driven ring-core, the radially pressable tread-forming roll for shaping the outer portion of the tire, and the radially movable spinning-rolls laterally spring-pressed against and rotated by the core for shaping the sides of the tire.

4. In a machine for the same purpose, the slow-speed mechanism for driving the ring-core while the fabric is being supplied thereto from a stock-roll and the fast-speed mechanism for actuating the ring-core during the action of the radially moving, laterally spring-pressed spinning-rolls.

5. In a machine for the same purpose, the power-driven ring-core and stock-rolls, and the stretching-roll provided with divergent spirally arranged sets of grooves for taking the longitudinal creases out of the fabric which are formed therein in its passage, under tension, from the stock-roll to the ring-core.

6. In a machine for the same purpose, the stock-roll for carrying a spiral winding of rubber-coated fabric and muslin, the yieldingly mounted take-up roll, frictionally engaging the material of the stock-roll for receiving the muslin and the power-driven ring-core for receiving the rubber-coated fabric.

7. In a machine for the same purpose, the stock-roll, the tension-roll covered with a layer of vulcanized rubber and the power-driven ring-core.

Dated this 2nd day of November, 1909.

For the Applicant,

J. G. LORRAIN, M.I.Mech.E., M.I.E.E.,
Norfolk House, Norfolk Street, London, W.C.,
Chartered Patent Agent.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.
[Wt. 15—50/3/1914.]

A.D. 1909. Nov. 5. № 25,588.
STATE'S COMPLETE SPECIFICATION.

(4 SHEE
SHEE

(2nd Edition)

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

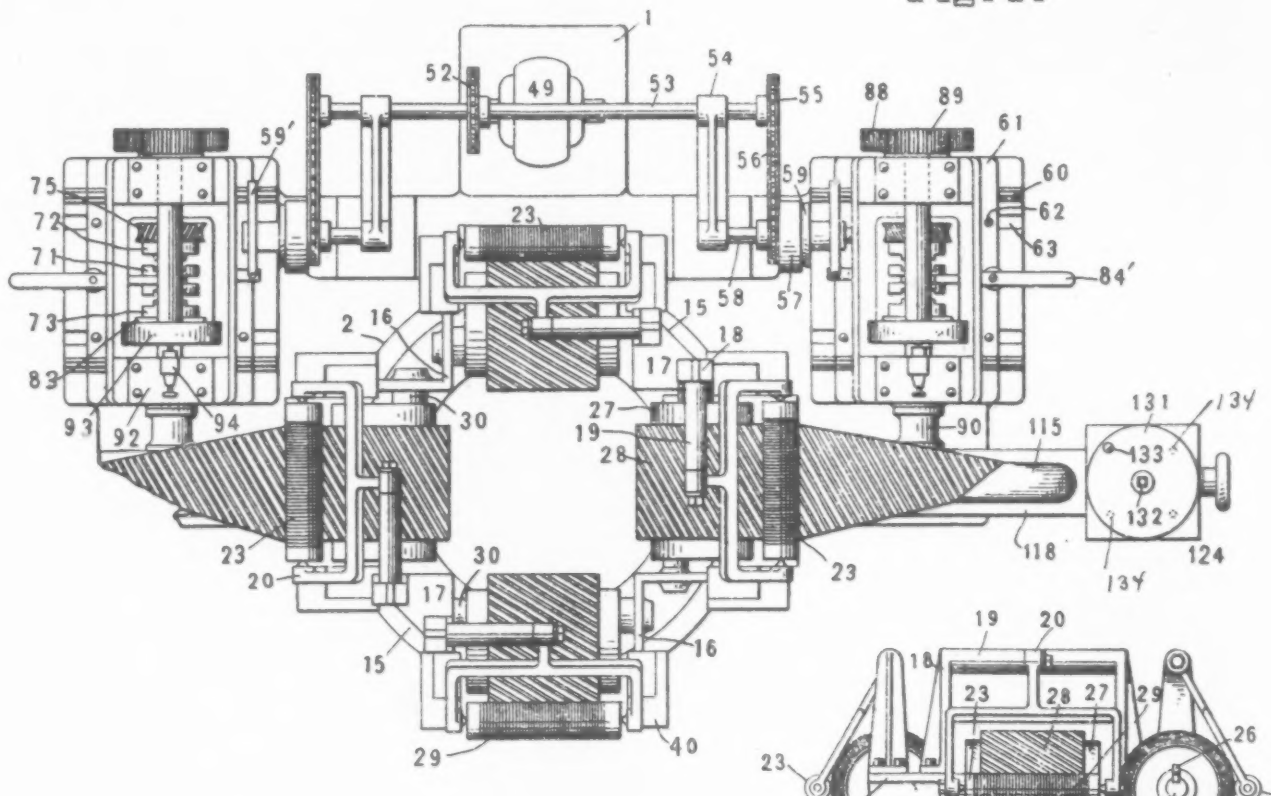


Fig. 2.

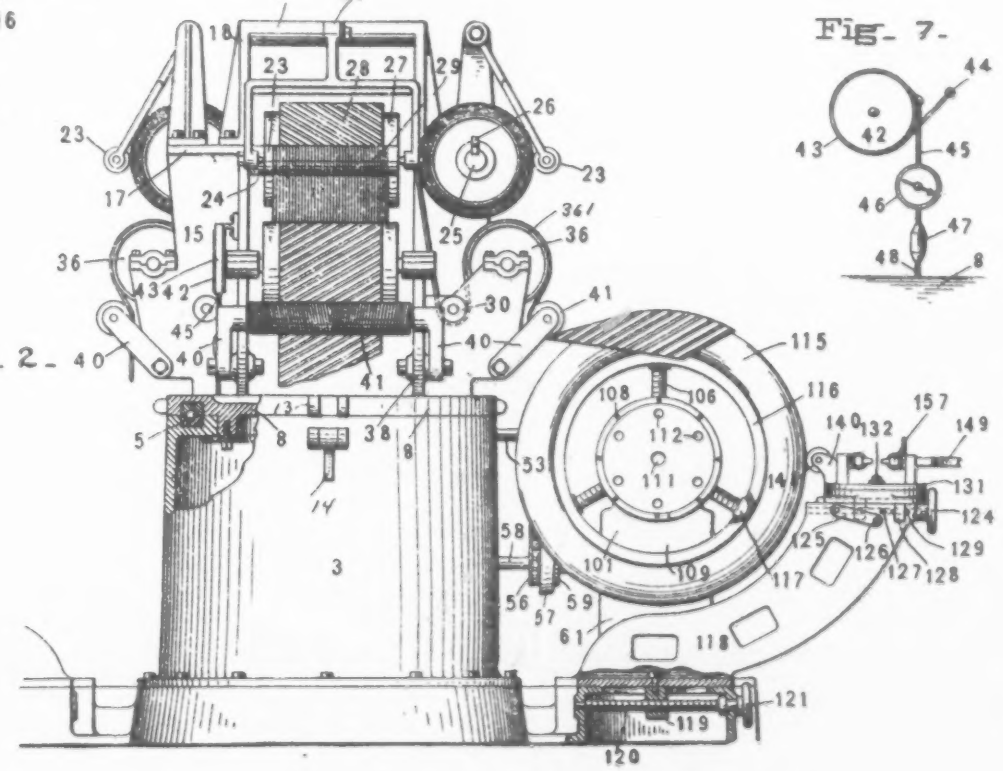


Fig. 7.

A.D. 1909. Nov. 5. No. 25,588.
STATE'S COMPLETE SPECIFICATION.

(2nd Edition)

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 3

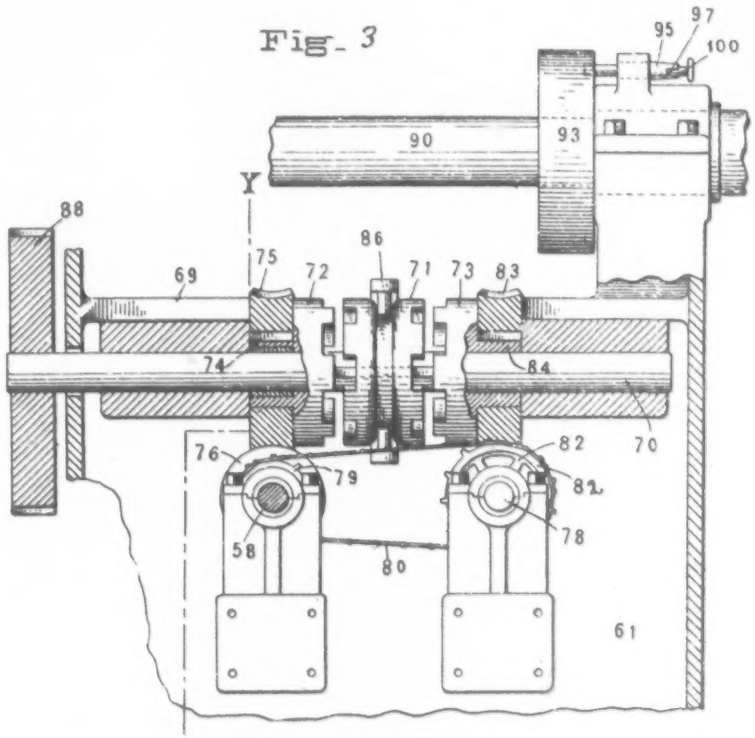


Fig. 4

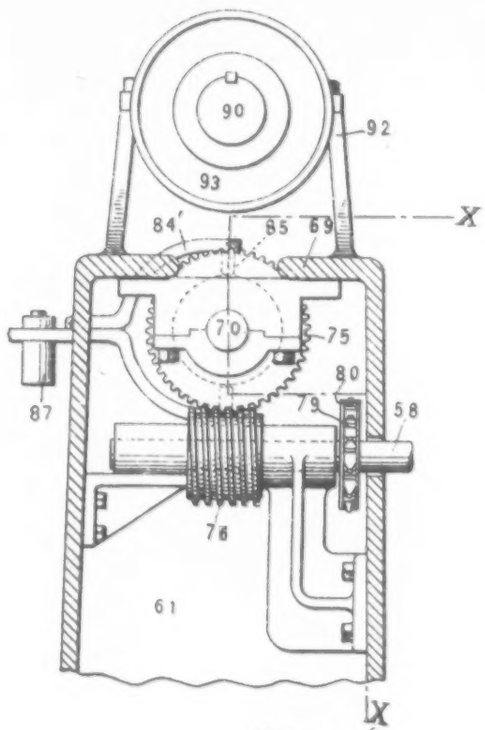


Fig. 5

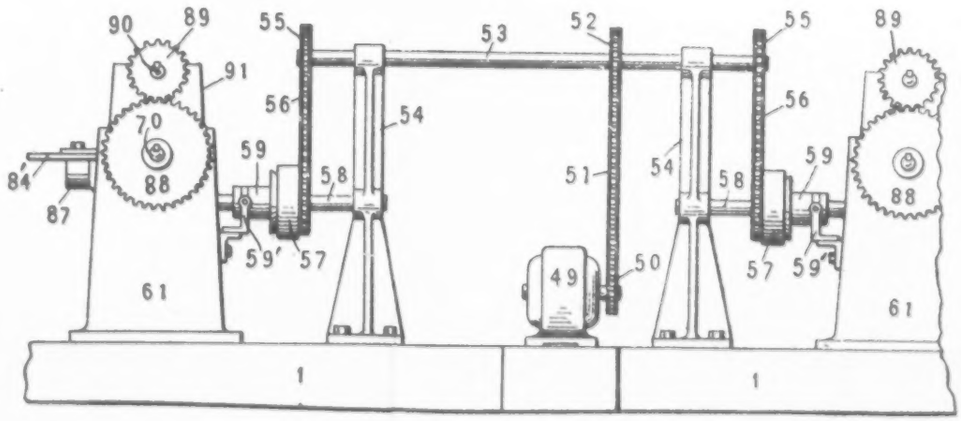
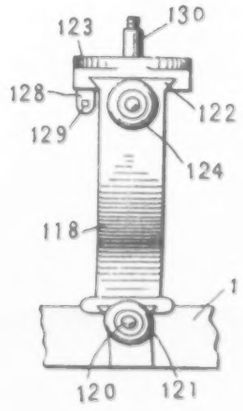


Fig. 6



A.D. 1909. Nov. 5. Nº 25,588.
STATE'S COMPLETE SPECIFICATION.

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 8.

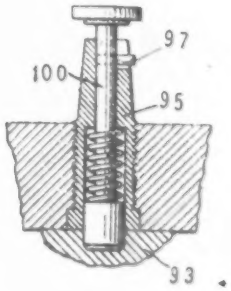


Fig. 9.

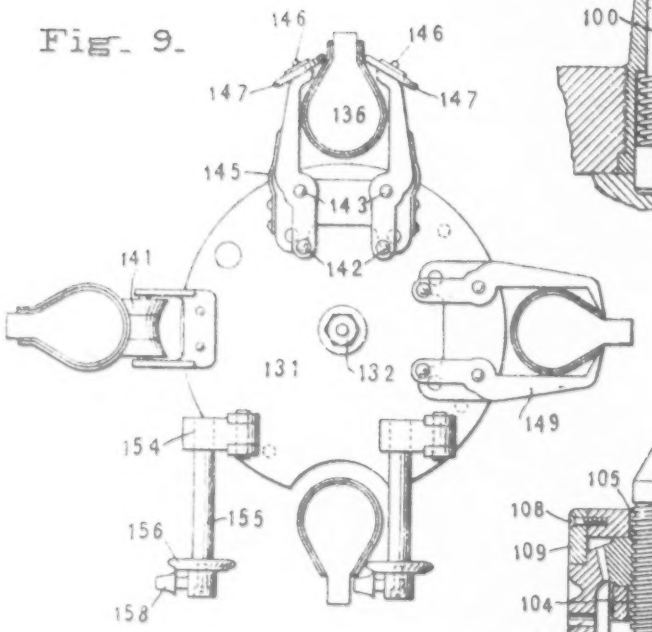


Fig. 10.

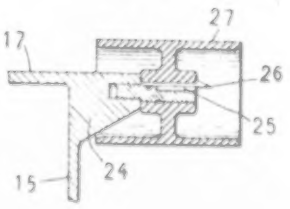


Fig. 11.

Fig. 12.

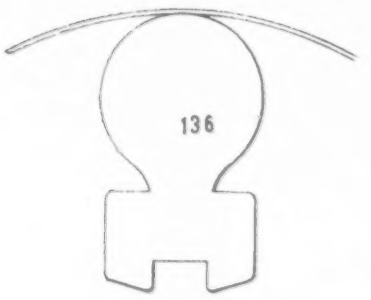


Fig. 12a.

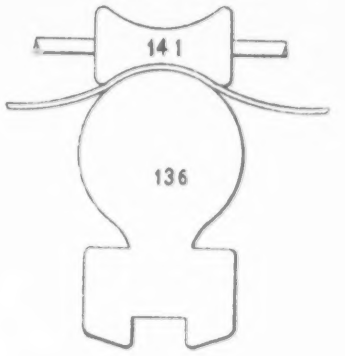


Fig. 12b.

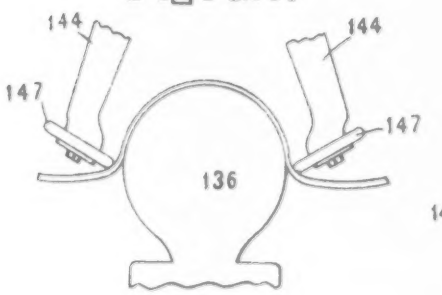


Fig. 12c.

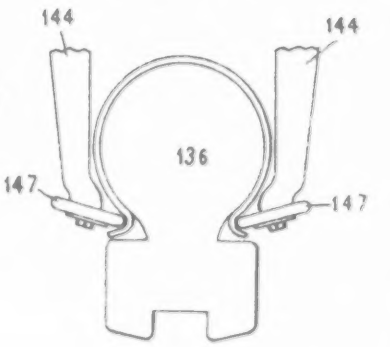


Fig. 13.

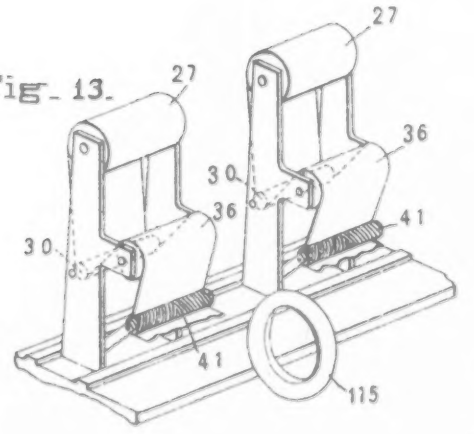
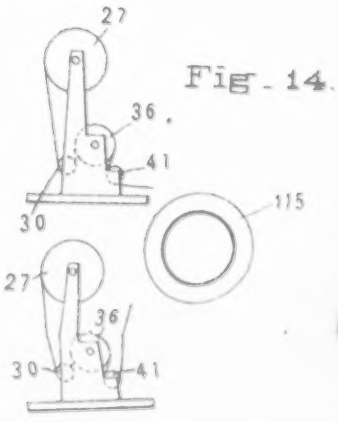


Fig. 14.



Defendant's Exhibit J—Vincent Patent.

No. 794,473. PATENTED JULY 11, 1905

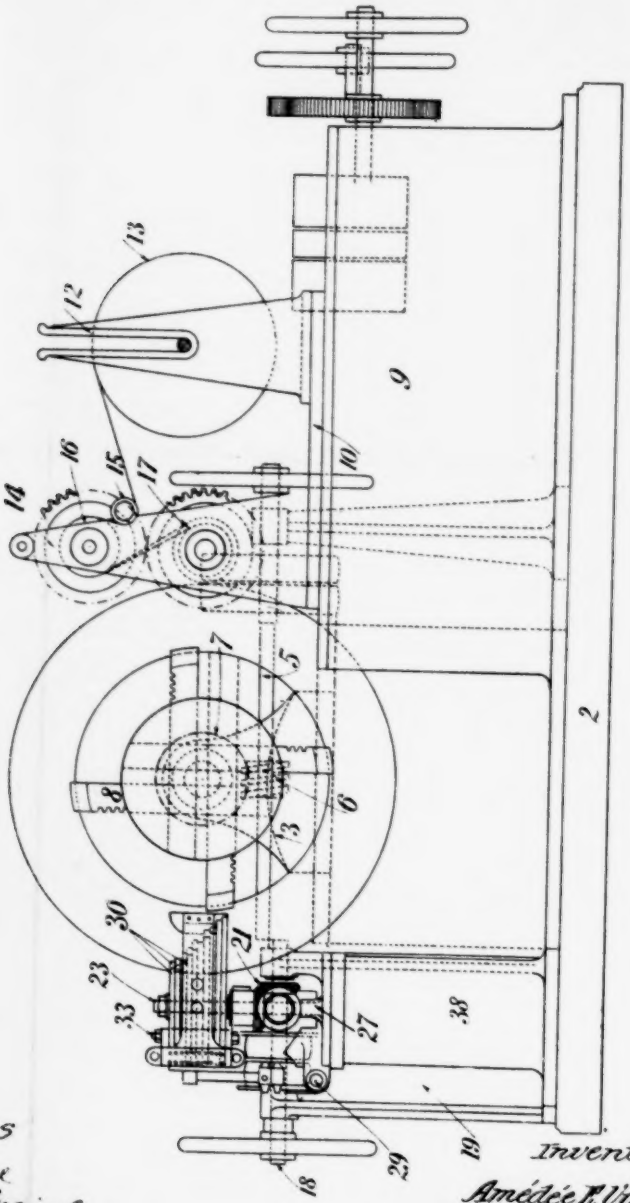
A. E. VINCENT.

MACHINE FOR MANUFACTURING PNEUMATIC WHEEL TIRES.

APPLICATION FILED APR. 7, 1905.

4 SHEETS—SHEET 1

FIG 1.



Witnesses
Arthur Kuehne
John A. Percival

Inventor
Amédée E. Vincent

By Richards & Co.
Attorneys

No. 794,473. PATENTED JULY 11, 1905.

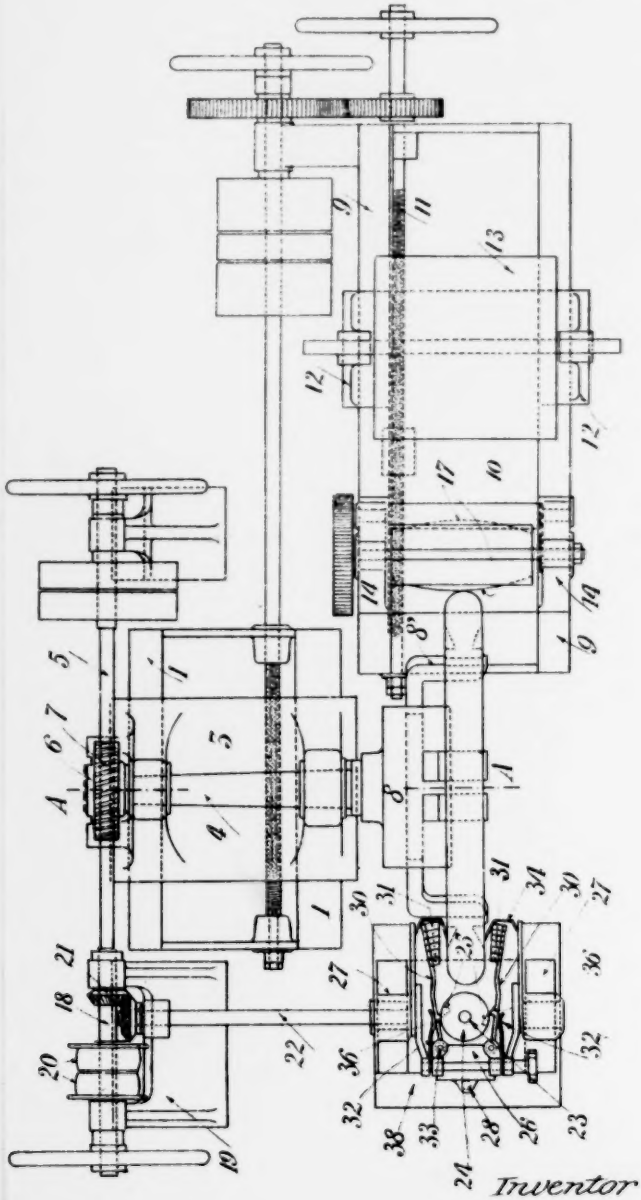
A. E. VINCENT.

MACHINE FOR MANUFACTURING PNEUMATIC WHEEL TIRES.

APPLICATION FILED APR. 7, 1905.

4 SHEETS—SHEET 2

FIG. 2.



Witnesses
Ann Kuehl
John A. Peraval

Inventor
Amedee E. Vincent
By Richards & Co.
Attorneys

No. 794,473. PATENTED JULY 11, 1905.

A. E. VINCENT.

MACHINE FOR MANUFACTURING PNEUMATIC WHEEL TIRES.

APPLICATION FILED APR. 7, 1905.

4 SHEETS—SHEET 3.

FIG 4.

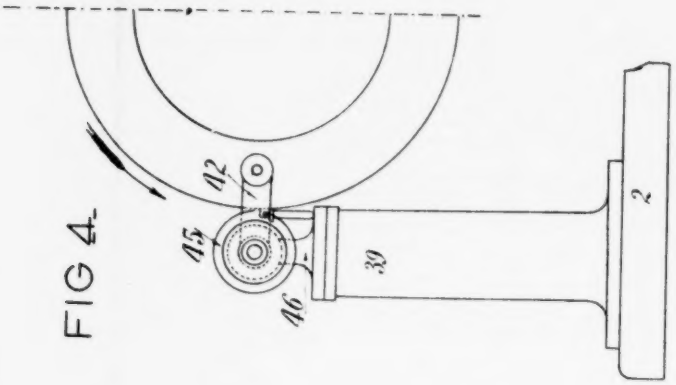
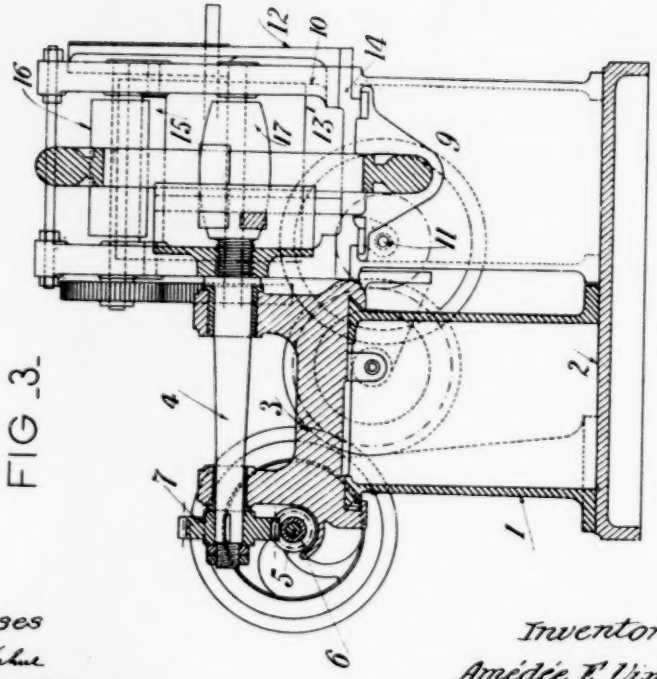


FIG 3.



Witnesses
Jno. Kuhn
John A. Percival

Inventor
Amédée E. Vincent
By Richards & Co
Attorneys

252

No. 794,473. PATENTED JULY 11, 1905.

A. E. VINCENT.

MACHINE FOR MANUFACTURING PNEUMATIC WHEEL TIRES.

APPLICATION FILED APR. 7, 1905.

4 SHEETS—SHEET 4

FIG 5.

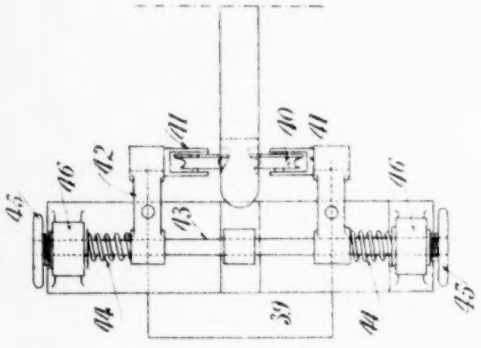
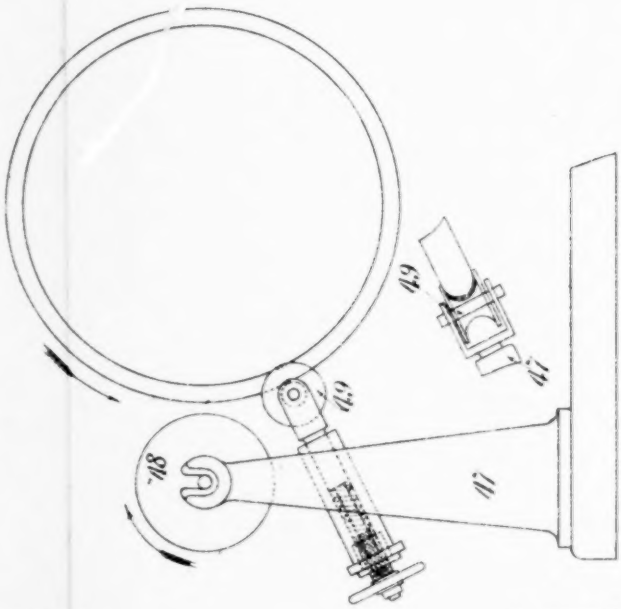


FIG 6.



Witnesses
Wm. Kuehne
John A. Brewing

Inventor
Amédée E. Vincent

By Richards & Co.
Attorneys

No. 794,473. Patented July 11, 1905.

UNITED STATES PATENT OFFICE.

AMÉDÉE ETIENNE VINCENT, OF NOISY-LE-SEC, FRANCE.

MACHINE FOR MANUFACTURING PNEUMATIC WHEEL-TIRES.

SPECIFICATION forming part of Letters Patent No. 794,473, dated July 11, 1905.

Application filed April 7, 1905. Serial No. 254,412.

To all whom it may concern:

Be it known that I, AMÉDÉE ETIENNE VINCENT, civil engineer, a citizen of France, residing at 25 Boulevard Gambetta, Noisy-le-Sec, Seine, France, have invented new and useful Improvements in Machines for Manufacturing Pneumatic Wheel-Tires, of which the following is a specification.

As is known, a pneumatic tire is made up of several layers of canvas cut in strips on a bias at forty-five degrees and of suitable breadth, two beads or flanges inserted at the base of the canvas, and an exterior layer of rubber for resisting friction.

This invention has for its object a machine for the mechanical production of these tires, enabling, first, to shape and stretch the canvas layers exactly to the same amount whatever be their number, so as to permit the different elements of the tire to work equally. By means of this machine canvas layers are mechanically applied and superposed in suitable number on a metallic matrix or former, and likewise the clenching beads or flanges of the tire and the exterior coating of rubber are mechanically set in place.

In the annexed drawings, Figure 1 is an elevation of the improved machine arranged to apply the canvas on the former. Fig. 2 is a plan view projected from Fig. 1. Fig. 3 is a transverse section along the line A A of Fig. 2. Figs. 4 and 5 show in elevation and in plan the arrangement serving to fix the beads on the tire. Fig. 6 shows the arrangement for applying and securing the tread.

The machine is constructed generally as follows:

A slide frame 1 is fixed on a sole-plate 2. The frame 1 carries a bracket 3, receiving a shaft 4, whose rotary movement is effected from a shaft 5, having a worm 6, operating a worm-wheel 7, keyed on the shaft 4. The other extremity of the shaft 4 is threaded and receives a plate 8 with four extensible arms 8'. On these arms there is placed the metal matrix or former intended to receive the canvas. A second frame 9 is mounted on the sole-plate 2, so that its axis will be in the same plane as the axis of the said matrix or former. On this frame 9 slides a carriage 10, whose movement is effected by a screw 11 engaging a nut fixed to the carriage. On this carriage 10 are fixed two supports 12, which receive a bobbin or reel 13, on which is wound the canvas for making up the tire. The carriage 10 carries also two other supports 14, between which are rotatably carried three rollers 15, 16, and 17. The roller 15 serves merely as a guide for the canvas. The rollers 16 and 17 are driven from each other by two toothed wheels of suitable diameter. The roller 16 is cylindrical. The roller 17 is bulbed in such a manner that the canvas which it receives from the roller 16 is at the middle developed to equal the summit or apex of the former or matrix, while the edges are developed corresponding to the edges of the former or matrix. The shape thus taken by the canvas permits of applying it to the former, covering the same perfectly. The canvas travels along the path indicated by the arrows, then is drawn on the former, which has previously received a coating of rubber solution to permit of the adhesion of the canvas and to insure its being turned with the former, which rotates with the plate 8.

The application of the first layer of the canvas on the former, then of the second on the first, and so on, is insured as follows: A shaft 18, carried by a support 19, fixed on the sole-plate, receives its movement from a system of fast and loose pulleys 20. Bevels 21 transmit motion to a shaft 22, which at its other extremity, also through bevels, drives a vertical shaft 23. On this shaft 23 are mounted a certain number of cams 24, each having two notches 25 opposite each other. The shaft 23 is mounted on a block 26, provided with two trunnions, permitting the same to rock between two supports 27 and to swing back to disengage the former. The block 26 carries at each side a series of levers 30 of unequal length, so that each of the hammers with which each lever is provided at its extremity projects a little beyond the preceding hammer. The whole of the hammers on each side constitutes a step system, as shown in Fig. 1, and all the hammers thus strike upon the face of the former. The levers are each provided with a catch or tappet 36 and are

pressed by springs 32. Each group of levers is mounted on the same shaft 33 at one side. When the shaft 23, on which are fixed the cams 24, makes a movement of rotation, the levers 30 remain superposed in the position indicated in Fig. 2 until the notches of the uppermost cam come opposite the tappets fixed on the two upper symmetrical levers. At this moment these two levers, always pressed by their springs, strike simultaneously upon the canvas on the former, then are immediately afterward raised by the cam, whose rotary movement continues. The second cam keyed beneath the first on the same shaft presents in turn its notches to the second pair of levers the hammers of which strike the canvas as did the first, and so on until the last set of levers, and this while the former, itself rotated in the direction of the arrow, presents successively all its surface to the blows of the small hammers, which first apply the first layer of canvas on the former and insure the perfect adhesion of each new layer of canvas on the preceding layer.

The mode of actuating the small hammers may differ from that above described; but the invention comprises the application to the manufacture of pneumatic tires of the system of small hammers or mechanical strikers striking in turn on the gummed and superposed sheets constituting the tire.

As it is necessary in course of manufacture to control the placing of the beads so as not to glue together all the canvas up to the lower edge, two movable pieces 34 are adapted, as shown in plan, to the hammer system and serve to separate the parts not requiring to be glued together.

For setting the beads or flanges, Figs. 4 and 5, there is employed a tool mounted on a bracket 39, which takes the place of the support 38 on the sole-plate 2 of the machine. The bead is engaged by the operator between the former and the profiled roller 40. This is placed in a chape 41, the tail of which is engaged in a boss 42, sliding longitudinally of the axis 43. The spring 44 presses the boss-support 42, and consequently presses the profiled roller 40, on the bead, and so insuring that the latter will adhere to the canvas of the tire. The tension of the spring 44 is regulated by means of hand-wheel 45, the screw-threaded nave of which moves in a nut fixed to the supporting-bracket 46.

The former, rotated in the direction of the arrow by the action of the spring 44, carries round in its rotation the profiled roller 40 and also the bead itself, which thus is wound and adheres to the tire at the exact position it ought to occupy. Additional rollers suitably profiled insure in the same manner the final adhesion of the upper layers of canvas on the bead thus fixed. There only remains then to effect a single operation, the simplest of all, the mounting of the exterior layer of rubber. This is done by replacing the bracket 39, carrying the bead-rollers, by a bracket 47, Fig. 6, arranged to receive a distributing-drum 48, on which has been rolled the rubber band previously calendered and constituting the rolling face of the tire. The adhesion of the gummed canvas body on the former is insured by a forming-roller 49, the chape of which is carried by the bracket 47. The pressure of said roller 49 on the former is obtained by an arrangement similar to that of the bead-rollers or any other suitable mechanical arrangement for this purpose. The rubber band being mounted on the former between the latter and the roller 49, the former is turned and rotating the band therewith causes to turn the roller 49 and the drum 48. The preparation of the tire is then complete. All the operations have been mechanically effected and the tire is ready for vulcanization.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A machine for the production of pneumatic tires comprising in combination a circular metallic former coated with rubber solution, a rotary plate 8, extensible arms 8 mounted on said plate and adapted to receive the circular metallic former, a bobbin 13 which furnishes the gummed canvas, rollers 15 and 16 over which pass the canvas, a bulbed roller 17 applied against the former and over which passes the canvas before it is applied on said former, small articulated hammers or mechanical strikers 30, 31 of different length and disposed in series on each side of the former, rotary cams 24 adapted to actuate said strikers, and springs 32 adapted to press the strikers against the former, substantially as and for the purpose set forth.

2. A machine for the production of pneumatic tires comprising in combination a circular metallic former coated with rubber solution, a rotary plate 8, extensible arms 8′ mounted on said plate and adapted to receive the circular metallic former, a bobbin 13 which furnishes the gummed canvas, rollers 15 and 16 over which pass the canvas, a bulbed roller 17 applied against the former and over which passes the canvas before it is applied on said former, small articulated hammers or mechanical strikers 30, 31 of different length and disposed in series on each side of the former, rotary cams 24 adapted to actuate said strikers, springs 32 adapted to press the strikers against the former, two profiled rollers 40 adapted to secure the beads or flanges to the tire, sliding supports 42 carrying said rollers, springs 44 acting on said supports and causing the rollers to be pressed against the cheeks of the former, substantially as and for the purpose set forth.

3. A machine for the production of pneumatic tires comprising in combination a circular metallic former coated with rubber so-

lution, a rotary plate 8, extensible arms 8' mounted on said plate and adapted to receive the gummed canvas, rollers 15 and 16 over which pass the canvas, a bulbed roller 17 applied against the former and over which passes the canvas before it is applied on said, former, small articulated hammers or mechanical strikers 30, 31 of different length and disposed in series on each side of the former, rotary cams 24 adapted to actuate said strikers, springs 32 adapted to press the strikers against the former, a drum 48 for distributing the external layer of rubber, a roller 49 adapted to apply said layer of rubber against the body of the gummed canvas mounted on the former, and a spring adapted to press said roller against the former, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AMÉDÉE ETIENNE VINCENT.

Witnesses:
ANTOINE LAVOIX,
ARMAND BLOCH.

Defendant's Exhibit K—Seiberling & Stevens Patent.

No. 762,561. PATENTED JUNE 14, 1904.

F. A. SEIBERLING & W. C. STEVENS.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE TUBE TIRES.

APPLICATION FILED NOV. 28, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

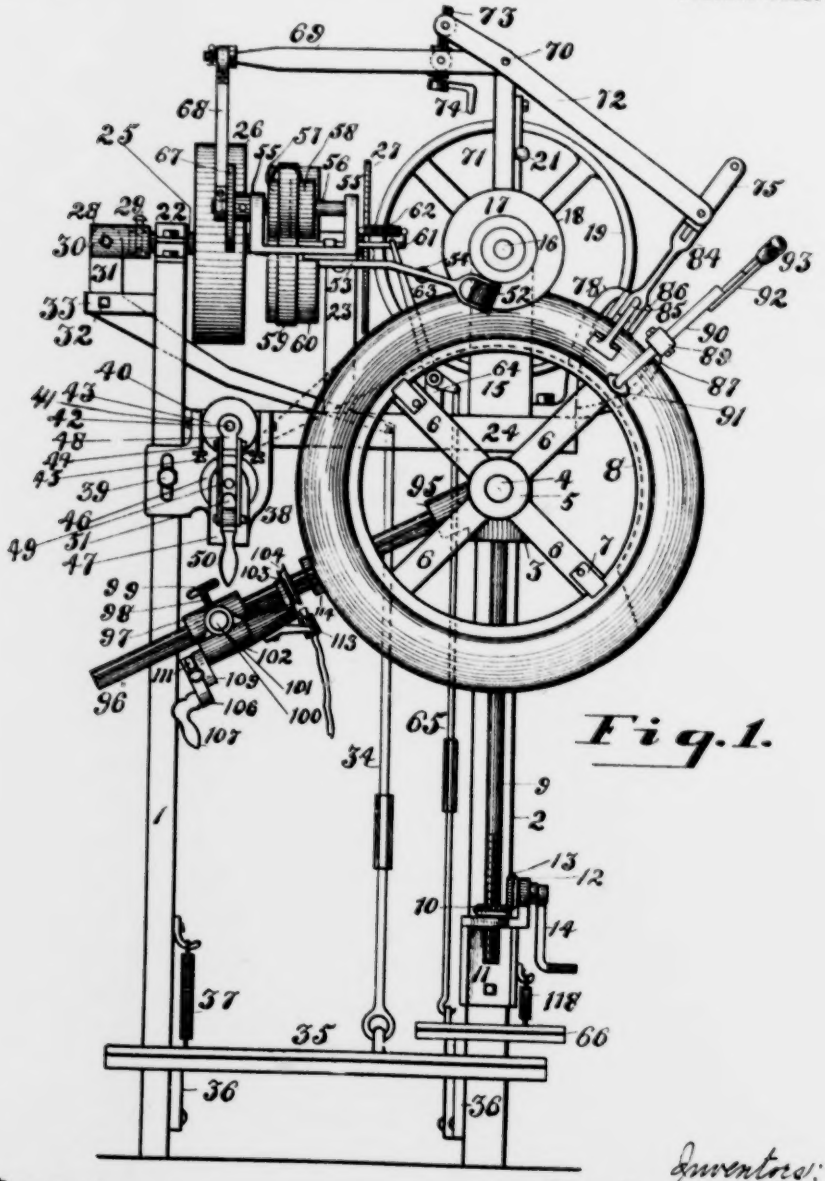


Fig. 1.

Witnesses:
Maude Boisler.
A. Seiberling

Inventors:
F. A. Seiberling and
W. C. Stevens,
By C. E. Humphrey,
Atty

260

No. 762,561. PATENTED JUNE 14, 1904.

F. A. SEIBERLING & W. C. STEVENS.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE TUBE TIRES.

APPLICATION FILED NOV. 28, 1903.

NO MODEL. 5 SHEETS—SHEET 2.

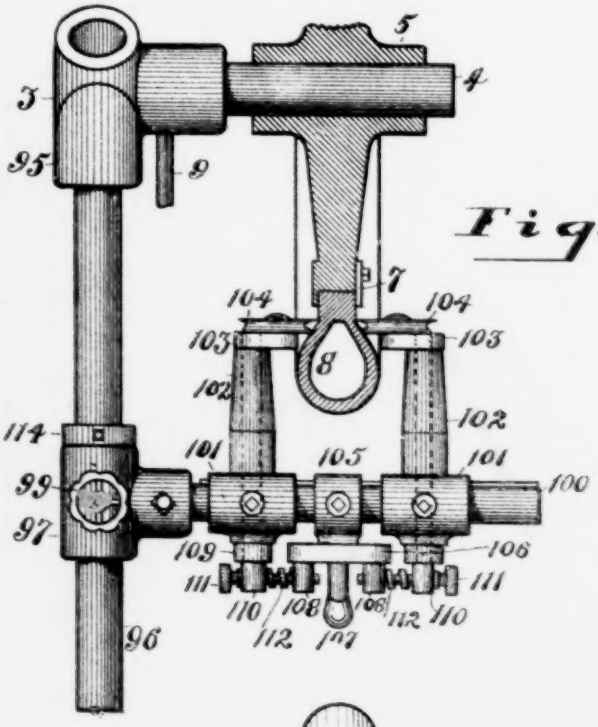


Fig. 2.

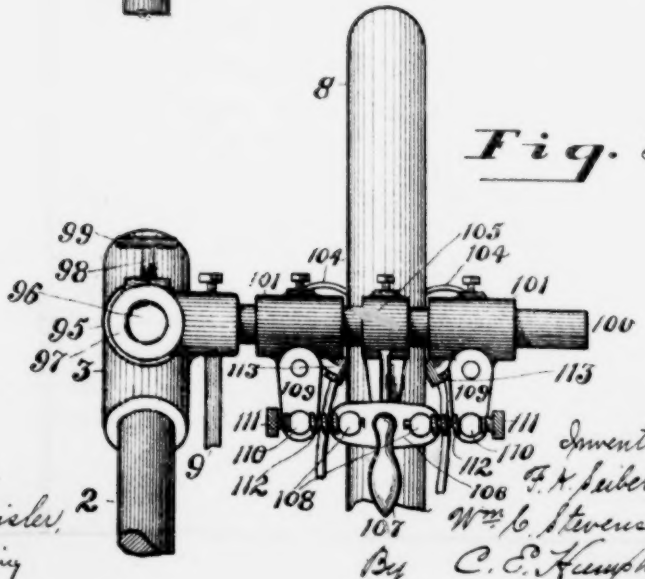


Fig. 3.

Witnesses:
Maude Spindler.
A. E. Kling

Inventors:
F. A. Seiberling
Wm. C. Stevens.
By C. E. Humphrey.
Atty.

No. 762,561. PATENTED JUNE 14, 1904.

F. A. SEIBERLING & W. C. STEVENS.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE TUBE TIRES.

APPLICATION FILED NOV. 28, 1903.

NO MODEL. 5 SHEETS—SHEET 3.

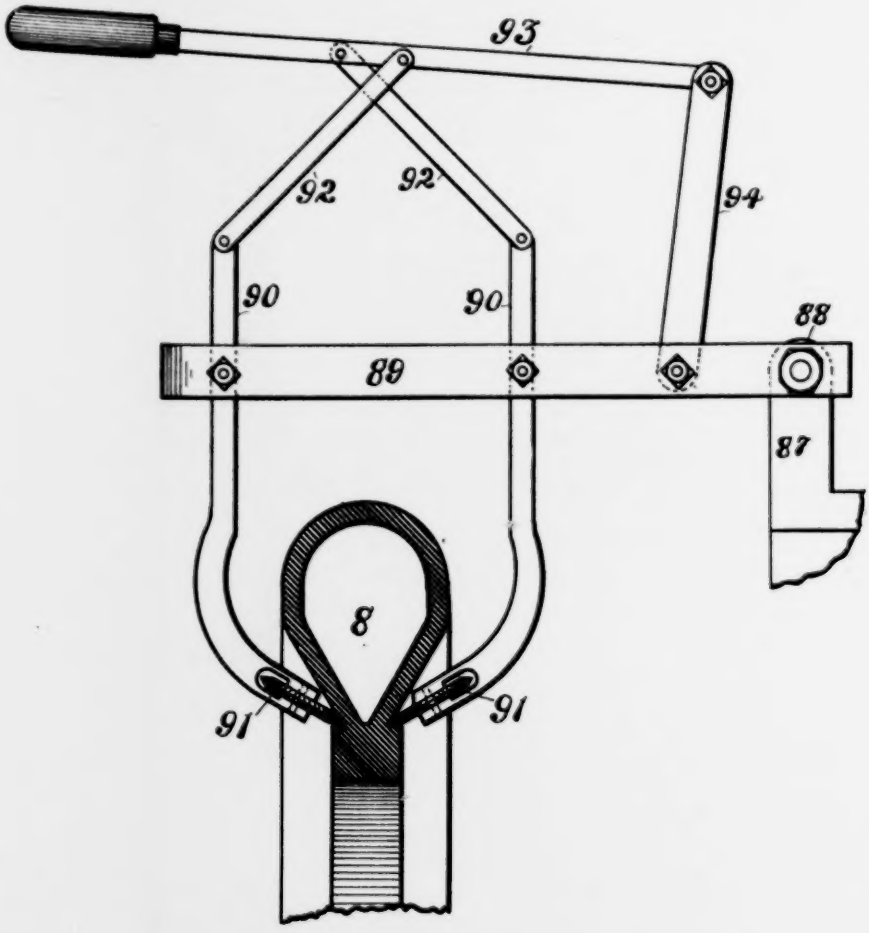


Fig. 4

WITNESSES:
Maude Spindler
C. A. King

INVENTORS:
F. A. Seiberling and
Wm. C. Stevens.
BY
C. E. Humphrey
ATTORNEY

No. 762,561. PATENTED JUNE 14, 1904.

F. A. SEIBERLING & W. C. STEVENS.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE TUBE TIRES.

APPLICATION FILED NOV. 28, 1903.

NO MODEL. 5 SHEETS—SHEET 4.

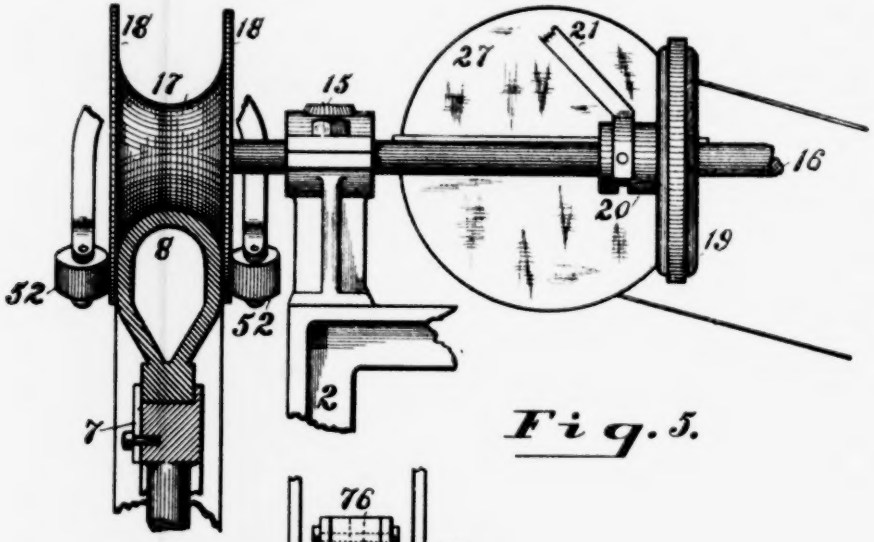


Fig. 5.

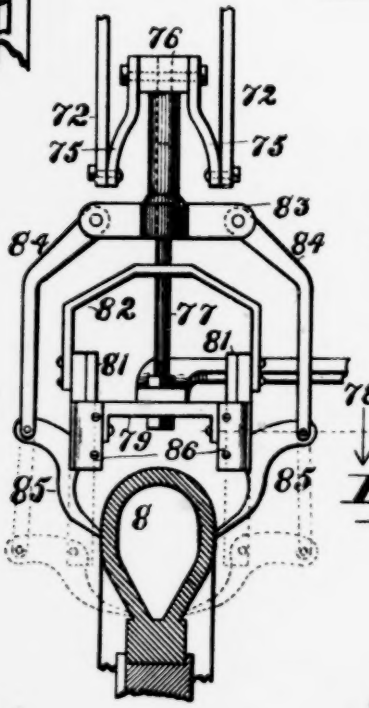


Fig. 6.

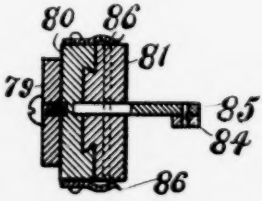


Fig. 7.

WITNESSES:
Maude Spisler
[illegible]

INVENTORS:
F. A. Seiberling and
Wm. C. Stevens,
BY
C. E. Thumbhurst
ATTORNEY

No. 762,561. PATENTED JUNE 14, 1904.

F. A. SEIBERLING & W. C. STEVENS.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE TUBE TIRES.

APPLICATION FILED NOV. 28, 1903.

NO MODEL. 5 SHEETS—SHEET 5

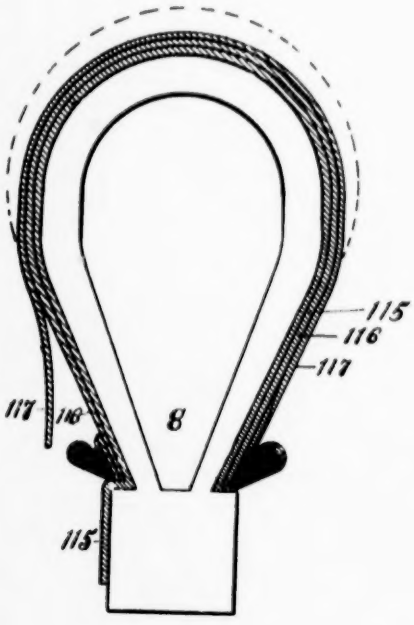


Fig. 8.

Witnesses:
Mandel Spindler.
A. D. King

Inventors:
F. A. Seiberling and
Wm. C. Stevens,
By C. E. Humphrey,
Atty.

No. 762,561. Patented June 14, 1904.

UNITED STATES PATENT OFFICE.

FRANK A. SEIBERLING AND WILLIAM C. STEVENS, OF AKRON, OHIO.

MACHINE FOR MAKING OUTER CASINGS FOR DOUBLE-TUBE TIRES.

SPECIFICATION forming part of Letters Patent No. 762,561, dated June 14, 1904.

Application filed November 28, 1903. Serial No. 182,987. (No model.)

To all whom it may concern:

Be it known that we, FRANK A. SEIBERLING and WILLIAM C. STEVENS, citizens of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented a certain new and useful Improvement in Machines for Making Outer Casings for Double-Tube Tires, of which the following is a complete specification.

This invention relates to machines for producing the outer tubes or shells of endless pneumatic tires, and is especially adapted to manufacturing comparatively heavy shells, such as are used for automobiles and heavy work.

The objects of this invention are to produce a machine by which the outer shells of heavy double-tube pneumatic tires may be rapidly and efficiently manufactured and to provide this machine with simultaneous coacting mechanism by which the successive layers of fabric of which the outer shell is composed may be laid and placed one upon another with great speed and accuracy and wherein the customary wrinkles and other roughness incident to the manufacture of these shells by hand are eliminated.

It is further an object of this invention to provide the mechanism hereinbefore referred to with suitable controlling means whereby different sizes of outer shells may be manufactured with such rapidity and regularity as has been heretofore unattainable.

To the accomplishment of the aforesaid objects this invention consists in the peculiar and novel construction, arrangement, and combination of the various parts hereinafter described, reference being had to the accompanying drawings, forming a part hereof.

In the accompanying drawings, in which similar reference-numerals indicate like parts in the different figures, Figure 1 is a front elevation of the entire machine; Fig. 2, a plan view, enlarged, of the means whereby the beading is placed on the tire; Fig. 3, an end view of the mechanism shown in Fig. 2. Fig. 4 is an enlarged view of a creasing device used in placing fabric in position; Fig. 5, a view showing the means by which power is communicated to the core on which the shell is built up; Fig. 6, a detail of a reciprocating or smoothing device for smoothing the wrinkles out along the sides of the shell while being constructed; Fig. 7, a section at the line *x* of Fig. 6; and Fig. 8, a sectional view of the outer shell of a pneumatic tire, showing one of the forms of tire which this machine is capable of manufacturing.

In the drawings, 1 2 are the upright sides of a frame on which the mechanism hereinafter to be described is mounted. On the upright 2, which may be round or angular, as preferred, is a carriage 3, from which projects at right angles a shaft 4, on which is a hub 5, capable of ready revolution on the shaft 4. From this hub 5 project spokes 6, a portion of which are provided with clips 7 for a purpose to be stated. The outer ends of all these spokes are provided with a flange on one side which serves to hold the inner side of a circular mandrel or core on which the outer shell of the pneumatic tire is built up. This core is preferably hollow for lightness and has the same exterior and conformation that it is desired to impart to the interior of the finished shell. The inner or base portion of this core 8 is held on the ends of the spokes 6 on one side by flanges referred to and on the other side by the clips 7, which are capable of being readily removed when desired.

From the lower end of the carriage 3 depends a threaded rotatable shaft 9, the lower end of which passes through the central portion of a threaded miter-gear 10, which serves as a nut for said shaft and is supported by resting on a bracket 11, bolted to the upright 2. This bracket 11 has also an upright arm 12, through which passes a shaft bearing at one end a miter-gear 13 and at its opposite end a crank-arm 14, by which the rotation of both miters and the ascent and descent of the carriage 3 is attained.

The revolution of the core 8 on the shaft 4 is effected by the following mechanism: Above the shaft 4 and parallel therewith and mounted in suitable brackets 15 on the frame of the machine is a shaft 16. On that part of the shaft 16 immediately above the core 8 is a

spool or roller 17, the central portion of which is concave and made of some suitable substance, such as vulcanized rubber covered with canvas, and the sides or ends of this spool 17 are composed of disks of heavy sole-leather 18.

On the rear portion of the shaft 16 and capable of longitudinal motion thereon is a friction-wheel 19 provided with a hub 20, both of which, together with the shaft 16, being splined to receive a key to compel the simultaneous revolution of said friction-wheel 19 with said shaft 16. A lever 21 is used to change the longitudinal position of this friction-wheel 19 on the shaft 16. It is obvious from the foregoing description that if the elevating-screw 9 is operated to raise the carriage 3 sufficiently to cause a snug engagement between the roller 17 and the core 18 the revolution of the friction-wheel 19 will rotate the core 8.

In order to rotate the friction-wheel 19, the following mechanism is employed: At right angles to the shaft 16 and mounted in brackets 22 on the frame 1 and on a bracket 23, mounted on a cross-bar 24, extending between the uprights 1 and 2, is a shaft 25, bearing a pulley 26, which is designed to receive power from a belt driven by any suitable or preferred source, the nature of which it is not essential to give in this description.

On the end of the shaft 25 adjacent to the friction-wheel 19 is a flat friction-disk 27, arranged to revolve with the shaft 25 and to be forced against and withdrawn from engagement with the friction-wheel 19 and to thereby cause the rotation of the shaft 16.

The shaft 25 is capable of longitudinal movement in its bearings and is actuated toward and away from the shaft 16 by the following means:

On the outer end of the shaft 25 is a cap 28, arranged to slip over the end of the shaft 25 and provided with a set-screw 29, arranged to enter a groove in the shaft 25 near its end, and thereby be retained thereon. In the opposite end of the cap 28 is pivoted, by means of a bolt 30, one end of a bell-crank lever 31, arranged to fulcrum on a bolt 32, passing through a bracket 33, attached to the upright 1. The lower end of this bell-crank is inwardly turned and is attached to a longitudinally-extensible rod 34, to the lower end of which is attached a pedal 25, mounted on pivoted arms 36 and normally kept upward by a spring 37.

From the foregoing description it will be seen that if the pedal 35 is depressed the shaft 25 will be inwardly moved, causing the engagement of the friction-disk 27 and the friction-wheel 19.

In order to impart a desired tension or stretch to the rubber-saturated fabric which is to compose the main portion of the shell or outer tube of the pneumatic tire, we provide the following mechanism: On the upright 1 is a bracket 38, held in place by a bolt 39, passing through a slot in the bracket to permit the vertical adjustment thereof. The rear upper portion of this bracket is bifurcated, leaving two upwardly-extending arms 40, across which extends a bolt 41, on which is pivoted one end of a shaft 42, bearing a loose roller 43. Over the rear portion of this roller passes a friction-band 44, capable of being tightened to a desired degree by thumb-nuts 45, so that a desired amount of resistance to its rotation may be imparted to this roller. Immediately below this roller 43 is a similar roller 46, but the shaft of which is rigid and is mounted between the back face of the bracket and an upwardly-turned portion 47, between which the roller rotates. On the front end of the shaft 42, bearing the roller 43, is a boss 48, on either side of the lower ends of which are straps 49, which have mounted between their lower ends a handle 50, having a cam-shaped head arranged to engage a boss 51 on the upright portion 47, the boss 51 being provided on its under surface with a suitable configuration to fit the cam-head of the handle 50.

The object of this arrangement is this. When it is desired to feed fabric to the core, the cam-handle 50 is released from engagement with the boss 51 and the upper roller 43 tilted upward on its pivot 41, permitting the insertion of a piece of fabric between the two rollers. Then the upper roller is lowered and compressed tightly against the lower roller by means of the mechanism just described. Sufficient pressure is then placed on the upper roller by means of the friction-band 44 to give a desired amount of resistance to the rotation of the rollers and the passage of fabric therebetween. From between these rollers the fabric is carried upward onto the core and passes under the roller 17, which smooths its upper surface, and partly down the sides of the core, this last feature being attained by two rollers 52, mounted on yoke-arms 53, pivoted to the upper portion of the bracket 23 and drawn toward each other by an inwardly-contracting spring 54. These rollers 52 have their axes radial to the center of the roller 17 and are arranged to press on the outer sides of the roller 17, which, as has been heretofore described, are made of sole-leather. The combined action of the roller 17 and the side rollers 52 serves to smooth the fabric down over the upper portion of the core and to a considerable distance downward therefrom. The mechanism by which the tire is smoothed from this point to the end of its rounded portion is as follows, reference being had to Figs. 1, 6, and 7, and may be described primarily as a reciprocating pair of fingers which slide up and down along the sides of the fabric on the core and smooth out the wrinkles with such rapidity of motion as to cover all portions of the fabric on the sides of the core during its revolution. Mounted on one portion of the bracket 23 is a small housing con-

sisting of a base and two uprights 55, mounted in which is a shaft 56, capable of rotating therein. In the central portion of this shaft between the uprights 55 is a loose and a tight pulley 57 and 58, over which passes a belt 59 from a pulley 60 on the shaft 25. The position of this belt with reference to the two pulleys 57 and 58 is determined by a belt-shifter 61, held normally in a position to retain the belt on the loose pulley 57 by a spring 62, which may be shifted by means of a bell-crank lever 63, pivoted on a bracket 64 on the cross-bar 24. To the opposite end of this bell-crank 63 is attached a longitudinally-extensible rod 65, to the lower end of which is attached a pedal 66, normally kept raised by a spring 118, so that by depressing the pedal 66 the bell-crank lever 63 will throw the belt-shifter 61 to one side and shift the belt from the pulley 57. On the outer end of the shaft 56 is a crank 67, to the wrist-pin of which is attached a connecting-rod 68, whose upper end is pivotally connected to a lever 69, pivoted on a bolt 70, passing through a post 71, rising from the housing 15, which sustains the shaft 16. This lever 69 is bifurcated except at the point where it passes through the eye of the connecting-rod 68. Also mounted on the bolt 70 is a lever 72, likewise bifurcated its entire length and having extending between its ends a shaft, (not shown but indicated,) which stands immediately above the lever 69. A similar shaft is mounted and pivoted between the sides of the lever 69, and an adjusting-screw 73 extends between these two shafts and is controlled at its lower end by a crank-arm 74, so that the angle between the levers 69 and 72 may be changed at will, and thus the extent of the rocking of the long end of the lever 72 may be accurately determined.

On the lower free rocking end of the bifurcated lever 70 is placed the mechanism by which the sides of the fabric are smoothed around the core, and the mechanism is best illustrated in Figs. 6 and 7. Between the ends of this lever 72 and attached thereto are short arms 75, which are fastened to opposite sides of a head-block 76, which is vertically perforated and arranged to slide upward and downwardly on a guide-rod 77, held firmly in position by a bent arm 78, bolted to any desired or preferred portion of the frame of the machine. On the upright guide-rod 77, below the place occupied by the supporting-arm 78, is a cross-bar 79, to the outer ends of which are fastened by screws or otherwise guides 80. These guides are provided on their outer faces with vertical dovetailed recesses into which fit vertically-reciprocating fulcrum-blocks 81, which are connected by an arch 82, extending between them and inclosing the guide-rod 77. At the lower end of the head-block 76 is a cross-bar 83, to the outer ends of which are pivoted bent levers 84, which depend therefrom and have their lower ends pivoted to the outer ends of shaping or smoothing fingers 85, the pivots of which are bolts in the fulcrum-blocks 81. The lower ends of these fingers 85 are nicely and smoothly rounded and are arranged to slide along the surface of the fabric and to compel the fabric to follow the contour of the core 8. On either side of the guide-blocks 80 are spring-plates 86, arranged to be retained and adjusted in place by screws and to press against the fulcrum-blocks 81 with a pressure to be determined by the work required of the fingers 85. The necessity for these spring-plates or friction-plates 86 is this, that as the head-block 76 rises and falls, carrying with it the cross-bar 83, bent levers 84, and fingers 85, the fulcrum-blocks, which bear the pivots for the fingers 85, would have a constant tendency to fall of their own weight, and obviously as rapidly as the fingers descend, and the fingers would exert no pressure on the fabric at their working ends; but by retarding the descent of the fulcrum-blocks 81 a considerable pressure is required on the outer ends of the fingers 85 to compel their descent, thereby forcing inward with considerably greater force the working or smoothing ends of these fingers. Experience has shown that these fingers work upward and downward with great rapidity, so much so as to cover every portion of the sides of the fabric and smooth out all wrinkles, both great and small, which exist or occur in the bending of the fabric around the core. After passing this smoothing device the fabric must then be tucked into a crease which exists near the lower end of the core and forced there with considerable pressure to cause it to adhere until it is desired to remove the finished shell from the core. This creasing of the fabric in the manufacture of tires is known to the trade as "stitching." The mechanism for stitching by forcing the fabric into this crease or depression is as follows and is shown in Figs. 1 and 4: From a suitable part of the frame of the machine extends a supporting-arm 87, the shape and configuration of which and its adjustment to the frame being of secondary consequence in the construction of this device. At its outer or free end it is provided with a bolt 88, which forms a pivot for a bifurcated arm 89, between the sides of which are pivoted two curved arms 90, the lower ends of which are inturned and are provided with sharp-edged rollers 91. At the upper ends of these arms 90 are attached links 92, arranged to cross each other and be pivotally fastened to a lever 93, provided at one end with a handle for the grasp of the operator and at the other end pivoted to a link 94, which in turn is pivoted to the bifurcated arm 89. This device is only used at intervals in the placing of the fabric on the core, and hence when not in use may be raised by simply raising the handle, which swings apart the lower ends of the arms 91, releasing them from engagement

with the fabric, and the whole device swings upward on the pivot-bolt 88 out of the way of the other mechanism of the machine.

In the construction of outer shells for heavy pneumatic tires it is customary to use a beading as a basis for forming a barb or grasping projecting on the lower portions of the shell to permit the inturned or clenching edges of the metallic tire of the vehicle to hook into, and this beading usually is made in a continuous strip with a hard soft-rubber core. By this is meant a rubber of such hardness as to be nearly as hard as what is known as "hard rubber," but still to retain sufficient inherent elasticity and flexibility as to permit its being bent and curved without cracking or breaking. This core is then surrounded by one or more layers of rubber-saturated fabric and placed against the sides of the fabric on the core. It is then covered by repeated layers of fabric and the whole united during vulcanization. In order to place this beading upon the sides of the fabric, which we will suppose to have been already placed upon the core, the following mechanism is used: On the side of the carriage 3 which sustains the core is a boss 95 into which is inserted and held by any preferred means a shaft 96. (See Figs. 1, 2, and 3.) This shaft 96 is designed to form an angle with the upright 2 of about sixty-three degrees and should be radial to the center of the shaft 4. On this shaft 96 is a slidable carriage 97, splined thereto. The retention of the carriage 97 on the shaft 96 at a desired point is obtained by means of a screw 98, operated by a hand-wheel 99. Projecting at right angles to the shaft 96 from the carriage 97 is a splined shaft 100, on which are mounted hubs 101 of long sleeve-like bearings 102, through which extend shafts. (Not shown, but indicated by dotted lines.) On the front ends of these shafts, inclosed in the sleeves 102, are fastened eccentric heads 103, and mounted on these heads 103 eccentric to the center of the shafts in the sleeves 102 are rollers 104, having the configuration of the outside of the beading to be placed on the shell in its construction. Between the hub 101 on the shaft 100 is another hub 105, which has depending from its rear face an arm to the lower end of which is pivoted on a substantially horizontal pin an elongated rocking plate 106, to which is attached a handle 107, by which it is rocked. From the face of this rocking plate 106 project two rotatable pins 108, for a purpose to be described. On the rear ends of the shafts inclosed in the sleeves 102 are depending crank-arms 109, and each has projecting from its lower end rotatable pins 110. The pins 110 and 108 are connected by adjusting-screws 111, having on their outer ends milled heads by which they may be rotated. These adjusting-screws 111 pass freely through the pins 110 and mesh into the pins 106, so that by revolving them the relative positions of the two crank-arms 109 to each other may be determined, which also determines the position of the grooved rollers 104 with reference to the core 8. Surrounding the adjusting-screws 111 are springs 112 to keep the crank-arms 109 normally thrown apart. Depending from the under faces of the sleeves 102 are brackets 113, having perforated heads, through the perforation of which the beading to be affixed to the tire is fed, thereby accurately feeding it into position, and as this perforation is a close fit for the beading it serves to prevent it from dropping to the floor when the beading mechanism is removed from operative connection with the core. On each of the hubs 101 and 105 are set-screws by which their positions may be fixed when determined. On the shaft 96 I customarily place a collar 114, held in a desired position by a set-screw or other preferred means with a view to regulating the position of the carriage 97 definitely and quickly when desired. Of course it is obvious that for different sizes of tires the position of the collar 114 will be varied to meet the requirements of the case. The operation of this bead-placing mechanism is as follows: Assuming that sufficient fabric has been placed on the core and the shell is in a proper condition to receive the beading and the parts are in the position shown in Fig. 1, with strips of indefinite length of beading in the guides 113, the screw 98, retaining the carriage 97 in place, is released and the carriage pushed forward toward the core until it encounters the collar 114. In doing this it is necessary to swing apart the rollers 104, so that they will pass around the main cylindrical portion of the fabric-covered core. As soon as the carriage 97 encounters the sleeve 114 the screw 98 is tightened and the handle 107 thrown to the position shown in Fig. 3, thereby pressing the rollers against the sides of the fabric at the proper place where it is desired to place the beading. The beading is then pushed upward and placed between the rollers 104 and the fabric on the core and the pedal 35 depressed, throwing the friction-disk 27 against the friction-wheel 19, causing the revolution of the core, and as it it revolves the bead on both sides of the core is fed onto the fabric and compressed there by the force of the rollers 104 until a complete revolution of the core has taken place, at which time the beading is severed from the continuous strip, the ends of the beading are nicely matched, the handle 107 swung a quarter of a revolution, throwing the rollers 104 away from the core, the screw 98 released, and the carriage 97, with its accompanying mechanism, swung out of the way, after which the placing of fabric on the partially-constructed tire is continued.

In Fig. 8 is shown one form of an outer shell which may be constructed on this ma-

chine, and the description of the process by which this shell is constructed will serve to illustrate the general construction of all tires which are to be made thereon. The first strip of fabric 15 is of sufficient width so that when fed onto the core the lower edges after being creased by the creasing-wheels 91 will lie on the flat portion of the core throughout the entire circuit thereof and of sufficient length to overlap a distance necessary to insure a perfect union between the two ends thereof. Next it is customary to place on the first fabric 115 a second layer 116, with the grain or warp thereof crossing the warp of the first layer, whose width is such as to just enter the crease between the outer portion of the core and the flat portion. After this beading is placed in position, as just described, then the lower edges of the first strip of fabric 115 are folded up around the beading and pressed against the inclined sides of the second strip of fabric 116 and caused to adhere thereto by the sticky nature of which it is composed. Then a third strip of fabric 117, of such a width as to extend down to the intersection of the beading with the shell, is placed on said second strip 116, and thereby covers the reflected ends of the first strip. Any preferred or desirable number of strips may be placed thereon, following this operation until the shell has acquired a desired thickness. Over this is placed a coating of rubber with a thickened portion on what will be the tread portion.

The core is removed from the spokes 6 by releasing the clips 7 and is taken to the vulcanizer and after being inclosed in a mold is properly vulcanized, after which the shell is stripped from the core by hand, this being easily accomplished by reason of the elasticity of the shell. The core is then returned to the machine and the process repeated.

What we claim, and desire to secure by Letters Patent, is—

1. The combination in a machine of the class specified of a tension device to simultaneously smooth and flatten strips of fabric, a revoluble core to receive said strips from said device, means to form said strips approximately longitudinally about said core and means to regulate the tension on said feeding device.

2. A machine of the class specified consisting of revoluble means to support the article to be built while in the process of manufacture and means for creasing or stitching portions of said article on said revoluble means.

3. A machine of the class specified involving revoluble means to sustain the article to be made during the construction and means for placing simultaneously suitable strips of beading on both sides of said article while on said revoluble means.

4. A machine of the class specified consisting of revoluble means to sustain the article while in construction, means to regulate the tension of the various parts of the article while being fed onto said revoluble means, means to smooth various portions of said article, means to crease or stitch said article and means to place strips of beading on said article while mounted on said revoluble means.

5. A machine of the class specified involving revoluble means for sustaining the article under construction, means to revolve said sustaining means, said last-named means being arranged to smooth certain portions of said article.

6. The combination in a device of the class specified of a revoluble core to sustain the article under construction, and a friction-roller adapted to transmit motion to said core and simultaneously smooth a certain portion of the article during said revolution.

7. The combination in a device of the class specified of a revoluble core to sustain the article while under construction, frictional means to bear on the article and revolve said core, means to feed material to said core, devices for smoothing material while on said core, and means to regulate the position of said revolving core with relation to said smoothing mechanism.

8. The combination in a device of the class specified of a revoluble core to sustain the article during construction, a carriage adapted to slide toward and away from said core, suitable mechanism mounted on said carriage to place suitable beading on the side of said article during construction of said article.

9. The combination in a device of the class specified, of a revoluble core to sustain the article while under construction, of reciprocating mechanism involving fingers to press and smooth the sides of said article while sustained on said revolving means.

10. The combination in a device of the class specified of a revoluble means to sustain the article while being constructed, of reciprocating means involving smoothing-fingers to work substantially radially to said supporting means and smooth the sides of said article while on said revoluble means, and means to regulate the stroke of said reciprocating means as desired.

11. The combination in a device of the class specified of a revoluble core to sustain the article while under construction, a roller to smooth the outer portion of the article while on said revolving means, said roller being provided with flexible sides, spring-pressed rollers to bear on said flexible sides to smooth a portion of the sides of said article during its revolution.

12. The combination in a machine of the class designated of a revoluble core to sustain the article while being constructed, a slidable carriage arranged to move toward and away from said core, shafts mounted in said carriage bearing eccentrically-pivoted rollers capable of placing a beading on the sides of said

article, and means to rock said shafts and throw said rollers toward and away from the article while on said revolving means.

13. The combination in a machine of the class designated of a revoluble core to sustain the article while being constructed, a slidable carriage arranged to move toward and away from said core, shafts mounted in said carriage bearing eccentrically-pivoted rollers capable of placing a beading on the sides of said article, means to rock said shaft and throw said rollers toward and away from the article while on said revolving means, and guides to direct and sustain strips of beading fed to said rollers.

14. The combination in a machine of the class designated of a revoluble core to sustain the article while under construction, a frame capable of being swung toward and away from said article, inwardly-movable arms on said frame, creasing-rollers on said arms and mechanism to force said creasing-rollers against a desired portion of said article while being constructed.

In testimony that we claim the above we hereunto set our hands in the presence of two subscribing witnesses.

FRANK A. SEIBERLING.
WILLIAM C. STEVENS.

In presence of—
C. E. BINGHAM,
GEO. W. ROGERS.

Defendant's Exhibit L—Moore Patent.

274

(No Model.) 3 Sheets—Sheet 1

G. C. MOORE.

MACHINE FOR MAKING SHOES OR COVERS FOR PNEUMATIC TIRES.

No. 518,112. Patented Apr. 10, 1894.

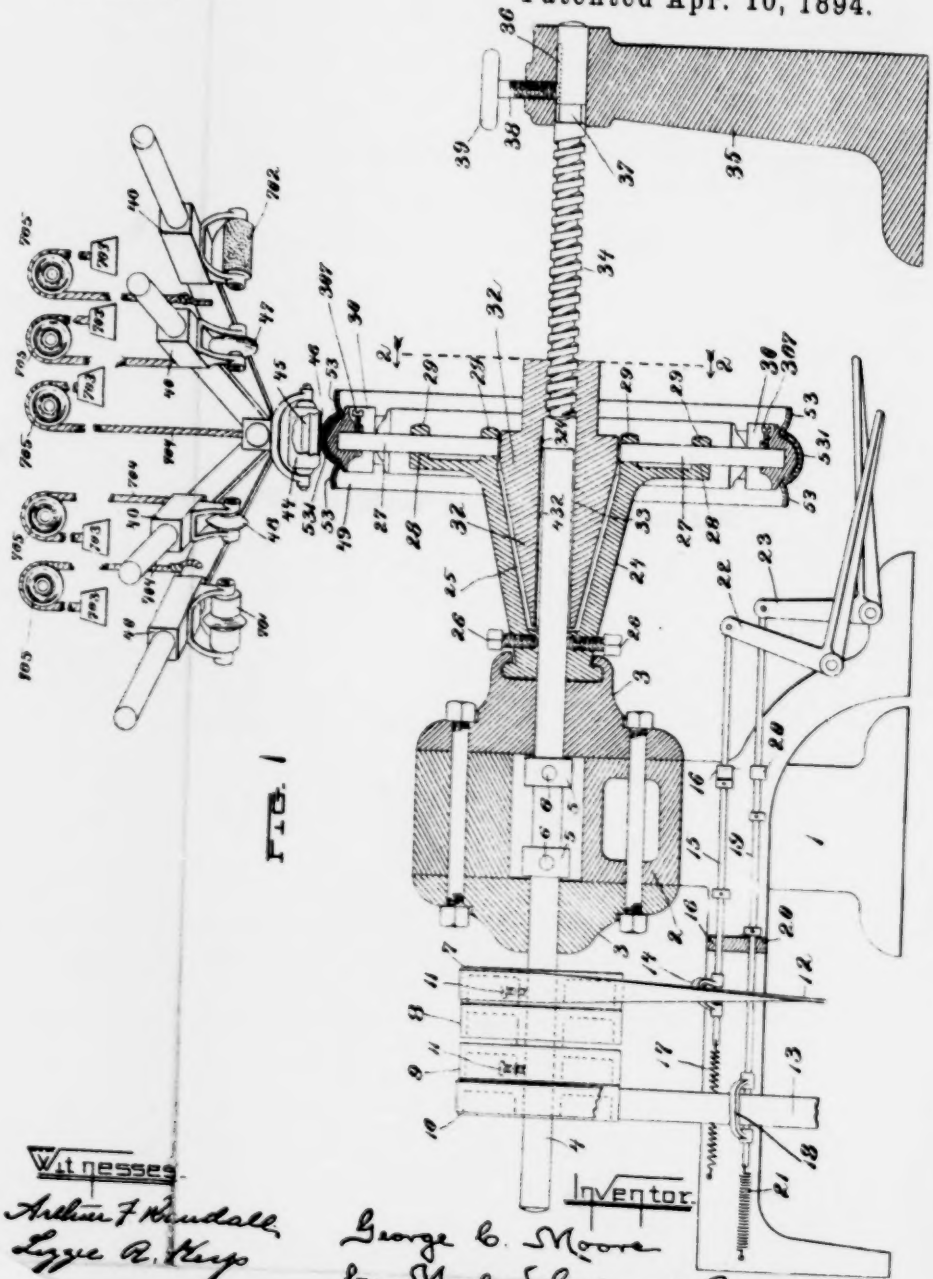


FIG. 1

Witnesses
Arthur F. Randall
Lyle A. Keys

Inventor.
George C. Moore
by Macleod Calver & Randall
his Attorneys.

(No Model.) 3 Sheets—Sheet 2.

G. C. MOORE.

MACHINE FOR MAKING SHOES OR COVERS FOR PNEUMATIC TIRES.

No. 518,112. Patented Apr. 10, 1894.

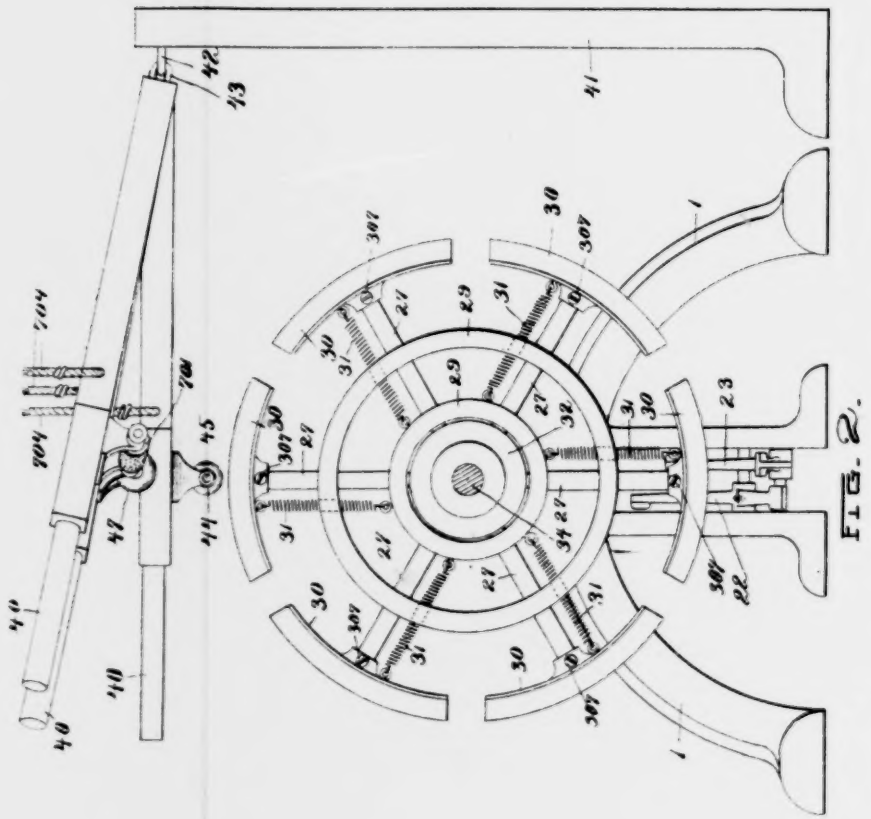


FIG. 2.

Witnesses.
Arthur J. Randall
Lizzie A. Kipp

Inventor.
George C. Moore
by Macleod Calvert Randall
his Attorneys

(No Model.) 3 Sheets—Sheet 3.

G. C. MOORE.

MACHINE FOR MAKING SHOES OR COVERS FOR PNEUMATIC TIRES.

No. 518,112. Patented Apr. 10, 1894.



FIG. 7

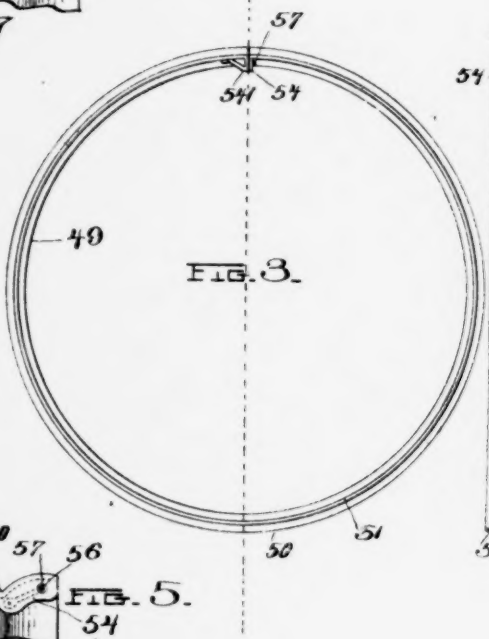


FIG. 3.



FIG. 4.

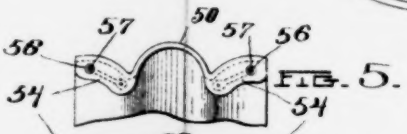


FIG. 5.



FIG. 6.

Witnesses
Arthur T. Randall
Robert Wallace.

Inventor.
George C. Moore
by Macleod Baker & Randall
his Attorneys

UNITED STATES PATENT OFFICE.

GEORGE C. MOORE, OF EASTHAMPTON, MASSACHUSETTS.

MACHINE FOR MAKING SHOES OR COVERS FOR PNEUMATIC TIRES.

SPECIFICATION forming part of Letters Patent No. 518,112, dated April 10, 1894.

Application filed December 5, 1893. Serial No. 492,828. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. MOORE, a citizen of the United States, residing at Easthampton, in the county of Hampshire and State of Massachusetts, have invented certain new and useful Improvements in Machines for Making Shoes or Covers for Pneumatic Tires, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of my invention is to provide a machine on which the shoes or covers of the pneumatic tires used on the wheels of bicycles, &c., may be conveniently and expeditiously manufactured.

The invention consists in certain novel features of construction and combination, and will first be described with reference to the accompanying drawings, after which the features thereof will be particularly pointed out and distinctively defined in the claims at the close of this specification.

The accompanying drawings show the best form of my machine which I have yet devised, but it is to be understood that various changes may be made therein without departure from the spirit of my invention.

In the drawings, Figure 1 is a view of my machine mainly in central longitudinal section. Fig. 2 is a view in vertical section on line 2—2 Fig. 1, looking toward the left in the latter figure, the shell being removed from the expanding former. Fig. 3 is a view in side elevation of the shell. Fig. 4 is a view of the shell in vertical section on line 4—4 Fig. 3, looking toward the left in the latter figure. Figs. 5 and 6 are views showing details of the shell. Fig. 7 is a view indicating the character of the lining fabric that I may use.

The illustrated form of my machine is constructed as follows:

At 1 is the frame supporting the main part of the said machine. The said frame has an upwardly extending portion 2 to the opposite sides of which are bolted boxes 3, 3, which are formed or provided with bearings for the horizontal shaft 4. On this shaft 4 between the boxes 3, 3, there are mounted collars 5, 5, which are secured in place on the shaft by clamping screws 6, 6, and serve by rotating in contact with the inner faces of the boxes 3, 3, to prevent movement of the shaft lengthwise in either direction. Any other approved means of preventing endwise movement of the shaft may be employed, if desired. On one end of the said shaft are mounted four band pulleys 7, 8, 9, 10, two of which, namely those marked 8 and 10 are loose upon the shaft, and free to turn thereon, while the remaining two pulleys, namely those marked 7 and 9 are fast on the said shaft, being secured thereto by clamping screws 11, or any other suitable means. To these pulleys are applied the driving bands 12 and 13, the band 12 being crossed, while the band 13 is straight or uncrossed. The crossed band passes through a loop 14 on the sliding shipper bar 15, which is supported and moves in guides 16, 16 on the frame work, and is held normally in the position which retains the said crossed band on the loose or idle pulley 8 by means of a spring 17, one end of which is connected with the said shipper bar, while the other end thereof is connected with the said frame work. The straight or uncrossed band 13 passes through a loop 18 on the second shipper bar 19, which is mounted in guides 20, 20, on the said frame work with capacity to move endwise therethrough, said shipper bar being normally held in position to retain the said straight or uncrossed band on the loose or idle pulley 10 by means of the spring 21 having one end thereof connected with the said shipper bar 19 and the other end thereof connected with the frame-work. The shipper bar 15 is connected with or engaged by a treadle or foot operated lever 22, and the shipper bar 19 is in like manner connected with or engaged by a second treadle or foot lever 23. By the pressure of the foot of the operator upon either of these treadles or foot levers, the corresponding shipper bar may be drawn endwise in opposition to the action of the spring connected thereto to shift the driving band which is controlled thereby from the loose or idle pulley around which it passes normally, onto the adjacent fast pulley, in order thereby to occasion the turning of the shaft 4 in the desired direction. To the end of the shaft 4 opposite that on which the band pulleys aforesaid are mounted is applied the head or hub 24. The said head or hub has a tapering chamber 25 formed therein and extending throughout substantially the length

of the head or hub, and is fixed or secured at its inner end to the shaft 4, as by means of clamping screws 26, 26, passing through the said inner end and taking bearing by their points against the surface of the shaft 4. The end of the shaft 4 projects to the outer end of the head or hub 24, and on the disk at the outer end of the said head or hub radial squared arms 27, 27 are mounted to slide toward and from the center of the said head or hub in guides formed on or applied to the latter. I have shown the said guides constituted by holes 28, 28, formed in two rings or flanges 29, 29 on the said disk. The said arms 27, 27 have applied to their outer ends segments 30, 30, sockets on the segments receiving the outer ends of the said arms, and the segments and arms being adjustably clamped together by means of screws 307, as shown; and the arms and segments are drawn toward the center of the head or hub, and of the shaft, by means of springs 31, 31 which are connected at their outer ends to either the segments as shown, or to the arms, and at ther inner ends are connected to some fixed part of the head or hub. The segments 30, 30 together constitute an expansible ring-shaped former, and the action of the springs is to draw the parts toward the center and contract it into the smallest dimensions.

At 32 is shown a tapering or cone-shaped block fitted to pass into the interior of the head or hub 24, the said block or cone having a central opening or hole 33 therethrough which, throughout at least the greater portion of its length, is of dimensions suitable to receive the end of the shaft 4, onto which the said block or cone is intended to be passed. When the said block or cone is passed into the interior of the head or hub the inner ends of the arms will be held in contact with the outer surface thereof by means of the springs 31, 31. Said block or cone constitutes an expander, and is intended to be moved gradually into the hub so as to force the arms and segments outwardly to increase the diameter and circumference of the expansible former, or be withdrawn so as to permit said arms and segments to be moved inward toward the center under the action of the springs 31, 31, in a manner to contract the diameter and circumference of the said expansible former. At its outer end the hole or passage 33 through the block or cone is threaded to fit the screw or threaded rod 34. The said screw or threaded rod is held by one end thereof, which is not threaded, in a stand 35 which is provided with a bearing for the reception of the said end. In the said end there is formed a longitudinal groove 36, and, also at the inner end of the said longitudinal groove, an annular groove 37, with which the said longitudinal groove 36 communicates. A clamping screw 38 having a hand-wheel 39, or suitable handle, at its outer end is fitted to a threaded hole in the said stand, and its inner end enters the annular groove 37 and longitudinal groove 36 as desired, and as will presently be explained.

At 40, 40 are levers, which, at their inner ends are loosely mounted or joined to an elevated support. The said support 41 has projecting therefrom a staple or half-ring 42 and each of the levers 40 has projecting from its rear end an eye 43 which is fitted onto the said staple. The described mode of connecting the levers with their support enables the said levers to be moved freely up and down as required, and to be slid laterally as may be desired in order to bring the required one thereof over the working point on the expansible former. A series of rollers or other implements is mounted on the said levers, one roller or the like to each lever, they being employed in the operations by which a tire is produced. The roller marked 44 is composed of a central shaft 45 and has an air-tight cylindrical casing 46 surrounding the said shaft except at the ends thereof, the said casing being filled with air and constituting what may be termed a pneumatic roll. The roller marked 47 is of wood, while the thin or disk-like roller 48 is of metal.

At 49, see Fig. 3, is shown a shell constituted by a ring of sheet metal which is severed or split at one point. This shell is intended to have the lining applied thereto, and is shaped properly in cross section. The shell shown in the drawings has an intermediate or middle curved portion or body 50 which, in cross section, may be made as part of a circle, and on each side thereof there is a curved wing 51. The shell is shown made of this shape in cross section in order to conform to the special form of lining fabric which is represented in the drawings, although it may be of any other desired and approved shape. The said illustrated lining fabric is woven with the middle or body part 531 and the wings 53, 53 on opposite sides thereof. At the meeting ends of the shell the said wings 51, 51, thereof are formed with inwardly extending projections 54, 541. These projections 54, 541, are perforated as at 56. To the projections marked 54 are applied catches 57, each consisting of a piece of spring wire, which is secured at one end to the lateral face of the corresponding projection, and has the other end bent to form a pin, which projects through the hole in the said projection, and is intended to pass into the similar hole in the opposite projection when the two projections are brought into the position which is shown in Fig. 3.

In making a shoe or cover for a pneumatic tire, I first take the shell and place it on the expanding former constituted by the segments. Prior to thus applying the shell to the expanding former, the latter has been caused to contract to its smallest dimensions by effecting, in a manner which will be made to appear more clearly hereinafter, the withdrawal of the expanding device constituted by the block or cone. When thus applied,

the ends of the shell overlap each other to some extent. A piece of lining fabric or material having been made into the form of an endless ring by means of cement or sewing is then put on the shell. Next, the screw or threaded rod and cone are advanced together by hand, or otherwise, as may be provided for, until the forward or small end of the cone has passed over the proximate end of the shaft, and the groove 324 in the interior of the cone has received the spline 432 on the said shaft. To permit the parts thus to be advanced, the clamping screw must first be turned slightly so as to relieve its pressure upon the screw or threaded rod 34 and leave the latter free to be moved endwise through the bearing provided therefor. As the said screw or threaded rod is thus moved the end of the clamping screw enters the longitudinal groove 36, and while the said end remains in the said longitudinal groove the screw or threaded rod is held from rotating, although remaining free to move endwise. The forward end of the expander cone having been introduced within the series of radial arms and engaged with the end of the shaft, the said clamping screw is turned to cause its inner end to bear with slight pressure against the bottom of the longitudinal groove in the screw or threaded rod in order to hold the latter from moving endwise until the force tending to occasion such movement exceeds the holding power of the screw. So long as the inner end of the said screw remains in the said longitudinal groove the screw or threaded rod will be prevented from rotating. By pressure of the foot applied to the treadle or lever 22 the shipper 15 is moved in a direction to shift the crossed belt onto the fast pulley 7. This causes the shaft 4 to be revolved in one direction, it carrying around with it not only the head or hub, and the expanding former carried thereby, but the expander cone. As the latter rotates in unison with the shaft and turns upon the non-rotating screw or threaded rod, its engagement with the thread of the latter causes the expander cone to be moved endwise into the chamber 25 of the head or hub 24, its tapering exterior acting to force outward gradually the arms 27 and the segments, thereby expanding the expansible former and the shell which surrounds the latter so as to stretch tightly the endless ring of lining material or fabric which has been applied to the said shell. When the advancing end of the expander cone comes into contact with the stop constituted by the inner end of the chamber within the head or hub its forward movement is brought to an end, the expansion of the former and parts applied thereto having been effected to the desired extent, and thereafter, inasmuch as the cone cannot advance, it presses rearwardly the screw or threaded rod 34, overcoming the friction of the clamping screw, the inner end of the clamping screw sliding in the longitudinal groove until the annular groove is presented to the inner end of the said clamping screw. When the said annular groove comes opposite to the clamping screw the screw or threaded rod becomes free to rotate in unison with the other parts and its endwise movement terminates, although the rotation is kept up at a high rate of speed during the performance of the operations which now are proceeded with. As the former expands, the overlapping ends of the shell slide upon each other until the expansion is completed, whereupon the said ends abut, the projections 54, 541, resting against each other as indicated in Fig. 3. When in this position the spring-catches 57, 57, which are now permitted to pass through the holes 56 in all of the said projections, serve to prevent the ends of the shell from slipping or moving sidewise on each other. While the parts continue to rotate, the cement is applied to the surface of the lining material or fabric and distributed uniformly by means of the roll 701, a suitable scraping knife being first applied, if desired. The cement employed consists of rubber and naphtha, mixed sometimes with a small proportion of benzine. The said roll has cylindrical portions for working upon the raised portions of the lining and a narrow raised portion for entering the depressions or angles. If desired a non-extensible twine or yarn, or suitable wire may now be wound on the lining at each side of the middle portion. Then the shell is removed and placed in a dry-room to partly dry the lining and thereby create the desired adhesive condition of the cement.

The removal of the shell is effected as follows: The distribution of the cement having been effected, the pressure upon the treadle or foot lever 22 is released and the spring 17 is permitted to move the shipper bar 15 in the reverse direction and carry the crossed belt from the fast pulley 7 to the loose pulley 8. The clamping screw is now turned down a little tighter against the screw or threaded rod and the treadle or foot lever 23 is pressed upon so as to move the shipper bar 19 in a manner to transfer the straight or uncrossed belt from the loose pulley 10 onto the fast pulley 9. This will rotate the shaft and parts moving in unison therewith in a direction which is the opposite of that in which they before were moved, and will thus cause the expander cone to move in the reverse direction along the stationary screw or threaded rod and thus gradually withdraw it from the interior of the head or hub. As the expander cone is withdrawn the arms or segments will be moved inward gradually so as to contract the expansible former. When the rotation of the parts has been continued long enough to disengage the expander cone from the end of the shaft, the pressure upon the treadle or foot lever 23 is released and the band 13 is permitted to pass onto the loose pulley 10. Then the clamping screw is turned out so as to withdraw its end from the annular groove of the screw or threaded rod 34, and

the latter is pushed outward slightly by hand or otherwise as may be provided for, so as to leave a free space between the end of the shaft and the side of the expansible former sufficient to permit the shell to pass therethrough in being taken away from the machine. The shell, which remains of the full size to which it was expanded, is now removed and taken away from the expansible former, and is set aside in a dry-room until the rubber has set set upon the lining fabric or material, after which the shell is applied again to the expansible former and the succeeding operation in the manufacture of the shoe or cover is performed. In the case of the lining fabric shown in the drawings it is intended to apply the shell having such a lining fabric thereon to the expansible former two more times in succession. The second time it is thus applied, which is after the cement has set as above noted, the wings of the lining are turned down onto the intermediate or middle portion to form the tread, the rolls 47 48, being successively brought into action, smoothing and stretching the said wings into proper position and condition, the narrow roller working into the angles of the shell. Then the pneumatic roller 44 is brought into action to even up the lining and expel air from between the layers. Another coating of cement is applied to the surface and the shell is removed and again placed in the dry-room to allow such coating to set. After the said coating has set, the shell is for the third time placed on the expansible former for the purpose of having the rubber covering put on, the latter being composed usually of sheet rubber. The pneumatic roller is used on the rubber covering to expel air and work the same into proper place and position. It is not intended to remove the lining fabric or lining from the shell after having been applied thereto, until the same is finished and thoroughly set.

The twine, yarn or wire which is inclosed between the layers at the lines of the folds serve to give strength and to form beads or ridges as customary in bicycle tires.

The felt covered roll 702 is used in spreading and working the different coatings of cement. Mounting the different rollers upon different levers as shown enables the desired one to be forced readily with the desired degree of pressure against the lining carried by the shell and mounted upon and rotating with the expansible former. I have shown the levers as normally raised out of the way by means of weights 703, the latter being attached to the ends of the cords 704 which pass around rollers 705, suitably mounted in an elevated position, said cords being attached at their opposite ends to the respective levers. By means of the said weights and cords the levers normally are held lifted but any one of them may be grasped and easily brought down in position to present its roller to the lining on the shell. In consequence of being movable freely laterally the levers may be swung laterally to bring the desired one with its particular roller over the rotating former.

I claim as my invention—

1. The combination of an expansible shell constituting a holder and support for the lining or foundation, with an expansible former to which the said shell is applied, means for supporting and rotating the said former, and means whereby the said former is expanded to also expand the said shell and stretch the lining or foundation applied thereto, substantially as described.

2. The combination of an expansible shell constituting a holder and support for the lining or foundation, and a catch for retaining the parts of the same in proper position when expanded, with an expansible former to which the said shell is applied, means for supporting and rotating the said former, and means whereby the said former is expanded to also expand the said shell and stretch the lining or foundation applied thereto, substantially as described.

3. The combination of an expansible holder and support for the lining or foundation, with means for expanding the same to extend and stretch the said lining or foundation first placed around the same, and for supporting and rotating the same, and rolls for operating on said lining or foundation while applied to and rotating with the said holder and support, substantially as described.

4. The combination of a holder or support for receiving and holding distended the lining or foundation, and means for supporting and rotating the same, of a pneumatic roll for operating on said lining or foundation while applied to and rotating with the said holder and support, substantially as described.

5. The combination with a driving shaft, means for rotating the same in either direction as desired, an expansible former rotating with said shaft, an expander constructed to be engaged and rotated in unison with the said shaft and former when placed in operative connection with the said former, and a screw operating to feed the expander when the latter is rotated, substantially as described.

6. The combination with a driving shaft, means for rotating the same in either direction as desired, an expansible former rotating with said shaft, an expander cone engaged by the said shaft, when said cone is placed in operative position, and thereby made to rotate with the said shaft and former, a feed screw engaging with the said cone and serving to move the latter endwise as required in varying the dimensions of the said former, and means for holding the said screw from rotation while the cone is feeding endwise in either direction, substantially as described.

7. The combination with a driving shaft, means for rotating the same in either direction as desired, an expansible former rotating with said shaft, an expander cone engaged by the said shaft, when the said cone is placed

in operative position, and thereby made to rotate with the said shaft and former, a feed screw engaging with the said cone and serving to move the latter endwise as required in varying the dimensions of the said former, the said screw having a longitudinal groove and a communicating annular groove, substantially as described, a support for the outer end of the said screw, and a locking screw adapted to enter said grooves, substantially as described and for the purposes set forth.

8. The combination with a rotating support or holder for the lining or foundation, of a series of working rollers or implements, a series of levers supporting the said rollers or implements and movable vertically to carry the latter toward and from the said support or holder and also movable laterally to enable the desired one to be brought into working position, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE C. MOORE.

Witnesses:

CHAS. F. RANDALL,

WM. A. MACLEOD.

Defendant's Exhibit M—Jeffery Patent.

No. 607,245. Patented July 12, 1898.

T. B. JEFFERY.

PNEUMATIC TIRE.

(Application filed Jan. 12, 1894.)

(No Model.)

Fig. 1.

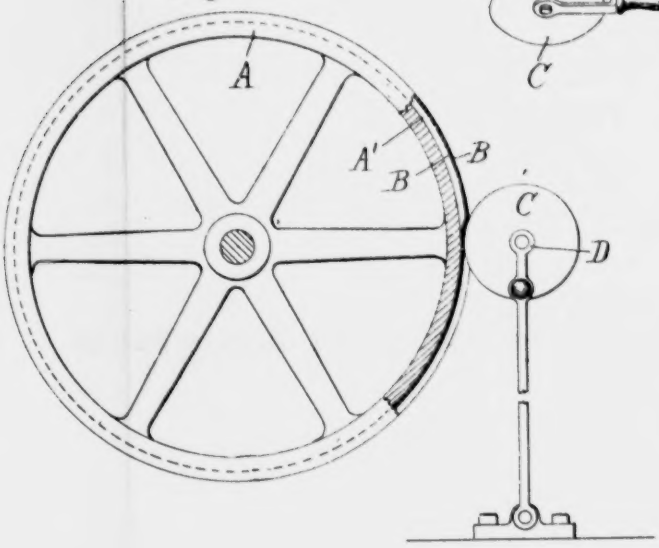


Fig. 3.



Fig. 2.

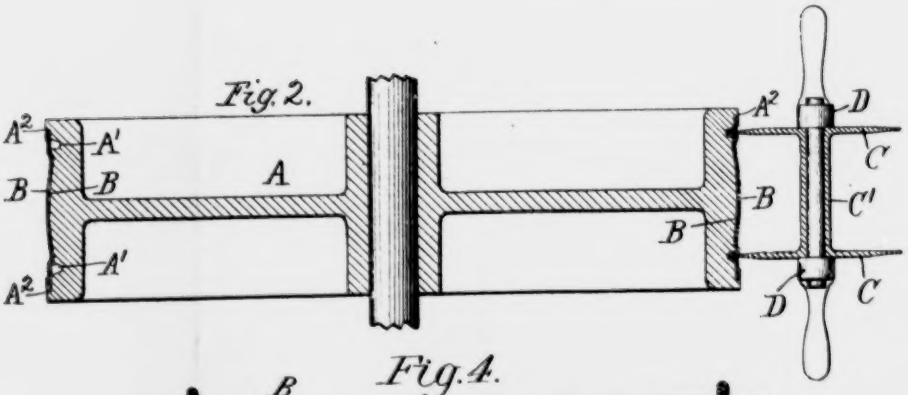
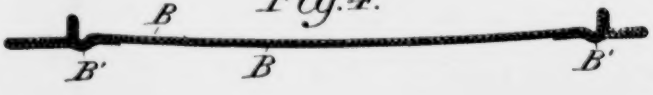


Fig. 4.



Witnesses.
S. J. Wray.
J. Elliott

Inventor.
Thos. B. Jeffery.

UNITED STATES PATENT OFFICE.

THOMAS B. JEFFERY, OF CHICAGO, ILLINOIS.

PNEUMATIC TIRE.

SPECIFICATION forming part of Letters Patent No. 607,245, dated July 12, 1898.

Application filed January 12, 1894. Serial No. 496,582. (No model.)

To all whom it may concern:

Be it known that I, THOMAS B. JEFFERY, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Pneumatic Tires and Processes of Making the Same, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention relates to the making of the covers or sheaths which constitute the outer portions of tires, commonly called "pneumatic," for vehicle-wheels, being adapted to inclose a disengageable rubber core, which, being inflated, fills the sheath and constitutes the air-cushion within it. Such tire sheaths or covers when applied to the wheel-rim and in use on the wheel with the core inflated are substantially circular in cross-section, as if a length of tubing had been wrapped around the periphery of the wheel and its ends joined, although a rift or opening is usually made at the inner circumference, so that the inflatable core may be placed within the sheath before the entire tire thus made is secured on the wheel-rim. The sheath, therefore, being in its condition of use substantially a rifted tube, it has been customary heretofore in making such sheaths to mold them—the material being rubber or rubber-saturated fabric—in substantially the form in which they will appear on the rim. In my improved process I depart from this method by making the sheath in the form of a flat band or short cylinder whose diameter is substantially that of the wheel which it is to fit and whose length or height is the circumference or outer measurement in transverse plane of the tire, and the cylindrical or tubular form which the tire-cover is to assume on the wheel is given to it merely by folding the lateral edges of such cylinder inward to their seats in the wheel-rim. Such tire-covers are in many of their forms arranged to be secured to the rims of the wheels by means of lateral beads or lips projecting from the tire-cover adapted to engage with suitable projecting lips forming recesses to receive the beads of the cover in the rim, and my process in detail is adapted to produce tire-covers of this description. For making such a tire-cover I provide, first, a pulley or wheel of substantially the diameter of the vehicle-wheel for which the tire is designed, and in its face I form grooves corresponding to the size of the tire measuring over the outside from bead to bead. This distance is usually within a small fraction (one-sixth to one-quarter) of the entire circumference of the tire. Upon this wheel I wrap a strap, or as many straps as may be desired, of fabric suitable for the tire-sheath, using, as is customary for such purpose, preferably a fabric which is saturated or charged to a suitable degree with rubber gum, rendering it adhesive, so that it adheres both to itself and to the wheel. This fabric I stretch or depress into the grooves described by the use of a suitable tool, and subsequently apply any covering or filling of rubber or other material which may be desired to give body to the sheath. The forming-wheel may be made of metal, and the tire-cover thus formed upon it may be vulcanized thereon by exposing the wheel containing it to proper temperature, and it may then be removed from the wheel, being readily stretched after vulcanizing enough to relieve it from the grooves mentioned.

In the drawings, Figure 1 is a side elevation of a drum or pulley and coöperating wheel used in my improved process, a portion of the drum being broken out to show the tire-cover in section thereon at a certain point. Fig. 2 is a section through the axes of the drum and coöperating wheel. Fig. 3 is a perspective of a hand-tool which may be used in lieu of the coöperating wheel shown in the other figures. Fig. 4 is a section transversely across the tire-cover, substantially full size, showing a detail modification for insuring permanence in the lugs.

A represents the forming-wheel, mounted on suitable bearings and having the grooves A′ A′ in its face.

B B represent layers or bands of fabric for the tire-cover applied about the face of the wheel A covering the grooves. One of these bands is wider than the other and has the excess extending on either side folded back over the edges of the first, so that the edges of the tire-cover, when formed, are folded edges and not raw. These bands B B are made of fabric cut bias, so that it is adapted

to be stretched down into the grooves in the wheel, as described, without danger of being ruptured in the process, and being, as indicated, saturated with adhesive gum when it is forced or stretched into the grooves, as described, it adheres therein, forming beads or ridges which tend to be permanent. This tendency is furthered by the fact that the two layers of bias fabric in slipping upon each other as they are stretched into the groove and adhering to each other at the positions to which they are stretched prevent each the other from returning if there were any natural tendency to return to the original flat form of the fabric. This tendency to permanency in the ribs or beads thus produced may be made complete and permanency of the beads positively secured by applying another strip or band of adhesive fabric outside the first after the grooves have been filled by depressing the fabric of the first thereinto, as described, this last band securing the fabric of the former bands together across the groove or channel into which the former has been depressed and prevent the fold thus laid from unfolding.

A^2 A^2 represent shoulders or margins of a channel in the face of the wheel which is the full width of the tire-cover to be formed thereon and which serve as gages at which the wider of the two pieces of fabric will be folded over the edge of the other, which is cut only of the width of the space between these gage-shoulders.

C is a wheel or roller having a dull knife-edged periphery adapting it to force the fabric into the grooves when it is pressed against the outer surface of the fabric as the latter lies over the grooves while the wheel A revolves. The wheel C may be mounted in a handle to be held by the operator while pressing the wheel into the grooves, as in Fig. 3, or there may be two such wheels mounted on a common hub C′ or roller provided with two beads, amounting to the same thing, carried in bearings D D, movable with respect to the forming-wheel A, so that both wheels may be simultaneously pressed up against the wheel A as the latter revolves and the fabric stretched into both grooves at once. There is some advantage in thus working upon both grooves at the same time, because thereby the fabric is drawn both ways from the middle at once and is not stretched out of position, as it might be if one line only were operated at a time. The tire-cover thus formed on the wheel may be without the tread-rubber, such tread-rubber being afterward cemented to it; but the device affords a convenient means of completing the tire-cover with the tread secured to it, which may be done by first wrapping the tread-rubber, which has been molded in a strip of proper cross-section, about the wheel A in the space between the two grooves A′ A′, which corresponds to the space to be occupied by the tread in the completed tire-cover. The fabric will then be applied outside the tread-rubber, as already described, and when the process of shaping on the wheel by stretching the fabric into the grooves is completed and the cover is ready for vulcanizing such vulcanizing process will unite the tread-rubber to the cover in the most perfect manner.

When it is desired to make heavy beads or lips for any purpose, the grooves in the wheel will be shaped accordingly, and any desired filling in the shape of a cord or strip of any material will be wound in the grooves into which the fabric has been depressed, thus further stretching the fabric into the groove if it has not been fully forced thereinto and occupying the space remaining.

If in any case it is desired to make a tire adapted to be turned and used either side out, a filling-strip wider than the depth of the groove or than the depth to which the fabric is forced into the groove will be wound thereinto and will project in a ridge or bead from the face of the wheel and another layer or layers to any desired number of fabric being then wound upon the wheel, another wheel E, having corresponding grooves, being moved up against the first and the two wheels revolved face to face with only the material which has been wound upon the first wheel between them, the last-wound fabric will be stretched over the protruding ribs of the filling and against the foremost fabric bands, to which it will adhere. If the tread-rubber is to be also applied to the cover before vulcanizing, it may be applied at the same time outside of the fabric, and the vulcanizing process being afterward completed the tire-cover will be alike on both sides and have properly-projecting beads adapting it to be used either side out and therefore adapting it to be reversed after being worn upon one side.

I claim—

1. A tire or tire-cover in the form of an endless seamless band as distinguished from a band whose ends are joined after the band is made, or a tubular annulus, such band being composed of fabric embedded in vulcanized rubber, and having beads or flanges parallel to the lateral edges, which, as to the vulcanized rubber are integral with the endless band, and which contain integral tucks of the fabric folded up into the beads or flanges embedded in the integral rubber substance thereof.

2. A tire or tire-cover in the form of an endless band composed of fabric embedded in vulcanized rubber and having beads or flanges parallel to the lateral edges, which as to the vulcanized rubber are integral with the endless band, and which contain integral tucks of the fabric folded up into beads or flanges into the integral rubber substance thereof; in combination with a layer of fabric which is also embedded in the integral rubber substance and extends across the base or back of the tucks.

3. A tire or tire-cover in the form of an endless seamless band as distinguished from one whose ends are joined after the band is made or from a tubular annulus, such band being composed of oppositely-placed layers of bias fabric whose threads are embedded in vulcanized rubber and having beads or flanges parallel to the lateral edges, which, as to vulcanized rubber, are integral with the endless band and which contain integral tucks of the bias fabric folded up into the beads or flanges in the integral rubber substance thereof.

4. A tire or tire-cover in the form of an endless seamless band as distinguished from one whose ends are joined after the band is made, or from a tubular annulus, such band being composed of rubber-saturated bias fabric having beads or flanges parallel to the lateral edges, which beads or flanges as to the rubber are vulcanized and integral with the endless band and which contain integral tucks of fabric constituting the exterior surface of the beads or flanges having its threads embedded with the vulcanized rubber as distinguished from being inclosed bodily in such rubber.

THOS. B. JEFFERY.

Witnesses:
JEAN ELLIOTT,
E. T. WRAY.

Defendant's Exhibit N—Bayne & Subers Patent.

No. 847,041. PATENTED MAR. 12, 1907

E. D. C. BAYNE & L. A. SUBERS.

AUTOMOBILE TIRE WINDING MACHINE.

APPLICATION FILED NOV. 19, 1906.

4 SHEETS—SHEET 1.

Fig. 2

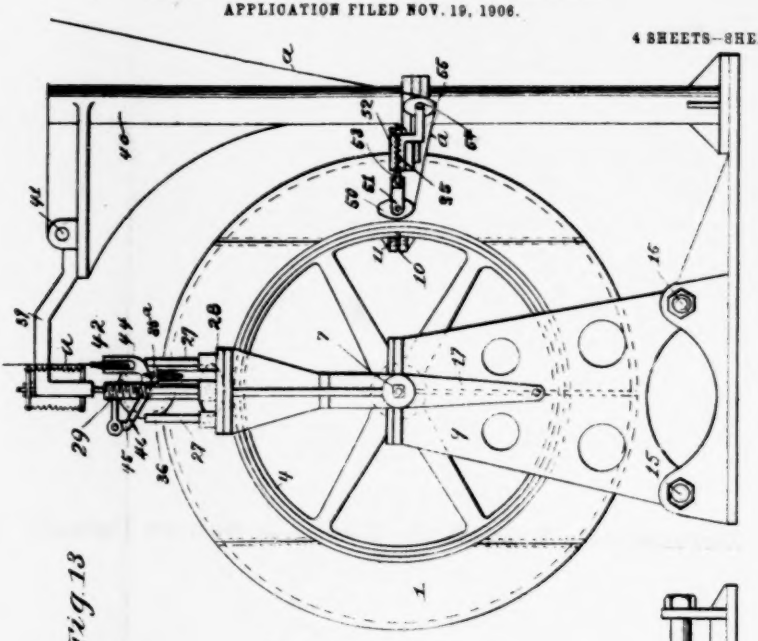
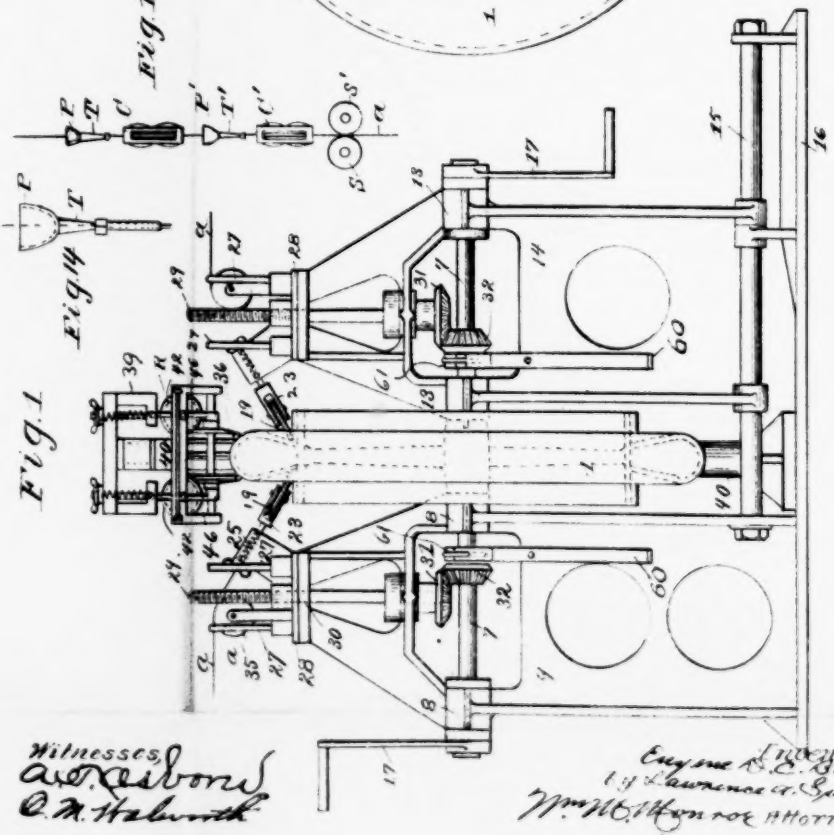


Fig. 13

Fig. 14

Fig. 1



Witnesses,
A. T. Osborn
C. M. Galbreath

Inventors
E. D. C. Bayne
L. A. Subers
By Lawrence & Subers
Their Attorney

294

No. 847,041. PATENTED MAR. 12, 1907.

E. D. C. BAYNE & L. A. SUBERS.

AUTOMOBILE TIRE WINDING MACHINE.

APPLICATION FILED NOV. 19, 1906.

4 SHEETS—SHEET 2.

Fig. 6

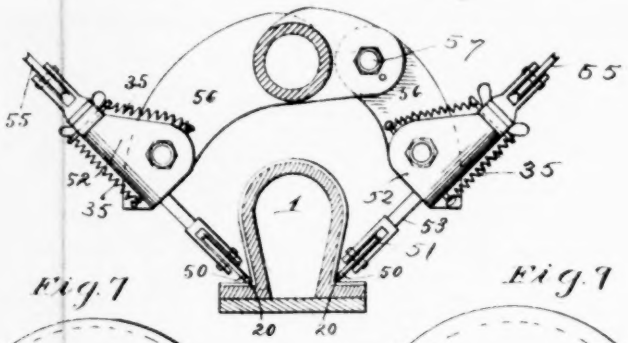


Fig. 7

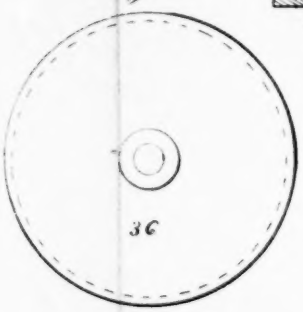


Fig. 9

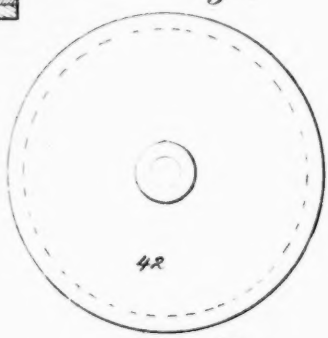


Fig. 8

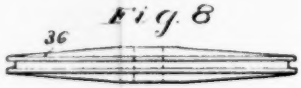


Fig. 10

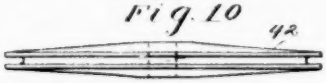
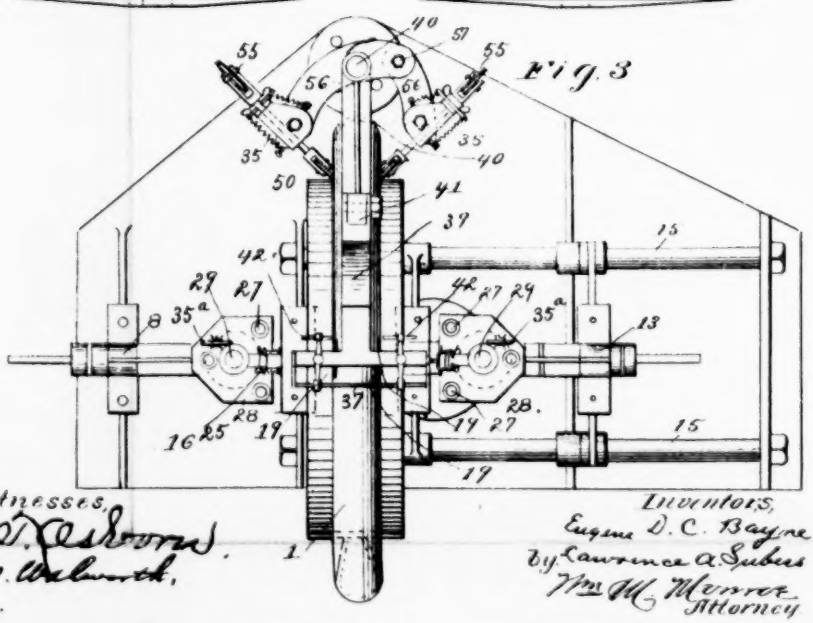


Fig. 3



Witnesses,
A. W. Osborne.
C. M. Wilmot.

Inventors,
Eugene D. C. Bayne
by Laurence A. Subers
Wm. H. Merrow
Attorney

No. 847,041. PATENTED MAR. 12, 1907.

E. D. C. BAYNE & L. A. SUBERS.

AUTOMOBILE TIRE WINDING MACHINE.

APPLICATION FILED NOV. 19, 1906.

4 SHEETS—SHEET 3.

Fig. 11

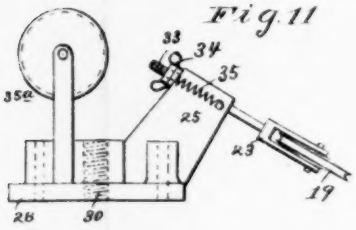


Fig. 4

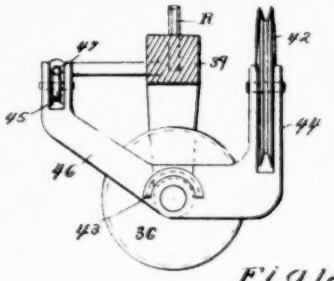
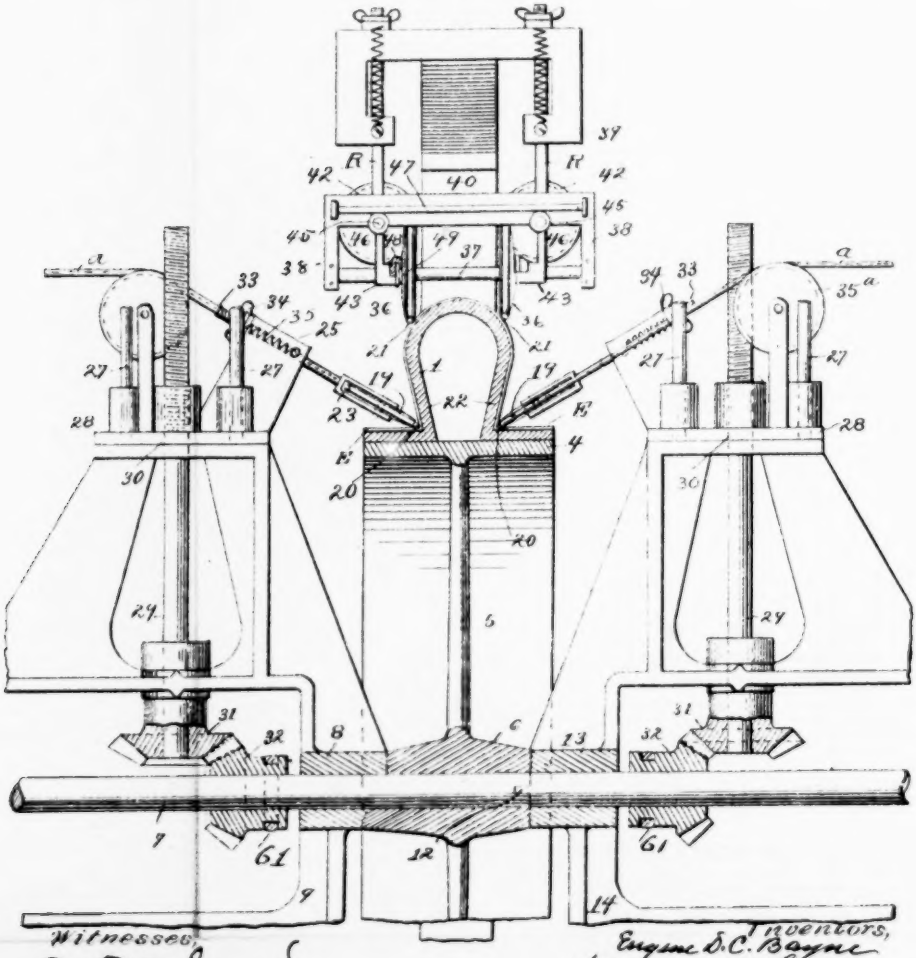


Fig. 12



Witnesses:
A. D. Osborne.
C. M. Wilmarth.

Inventors,
Eugene D. C. Bayne
Lawrence A. Subers
by Wm. H. Monnett
Attorney.

No. 847,041. PATENTED MAR. 12, 1907.

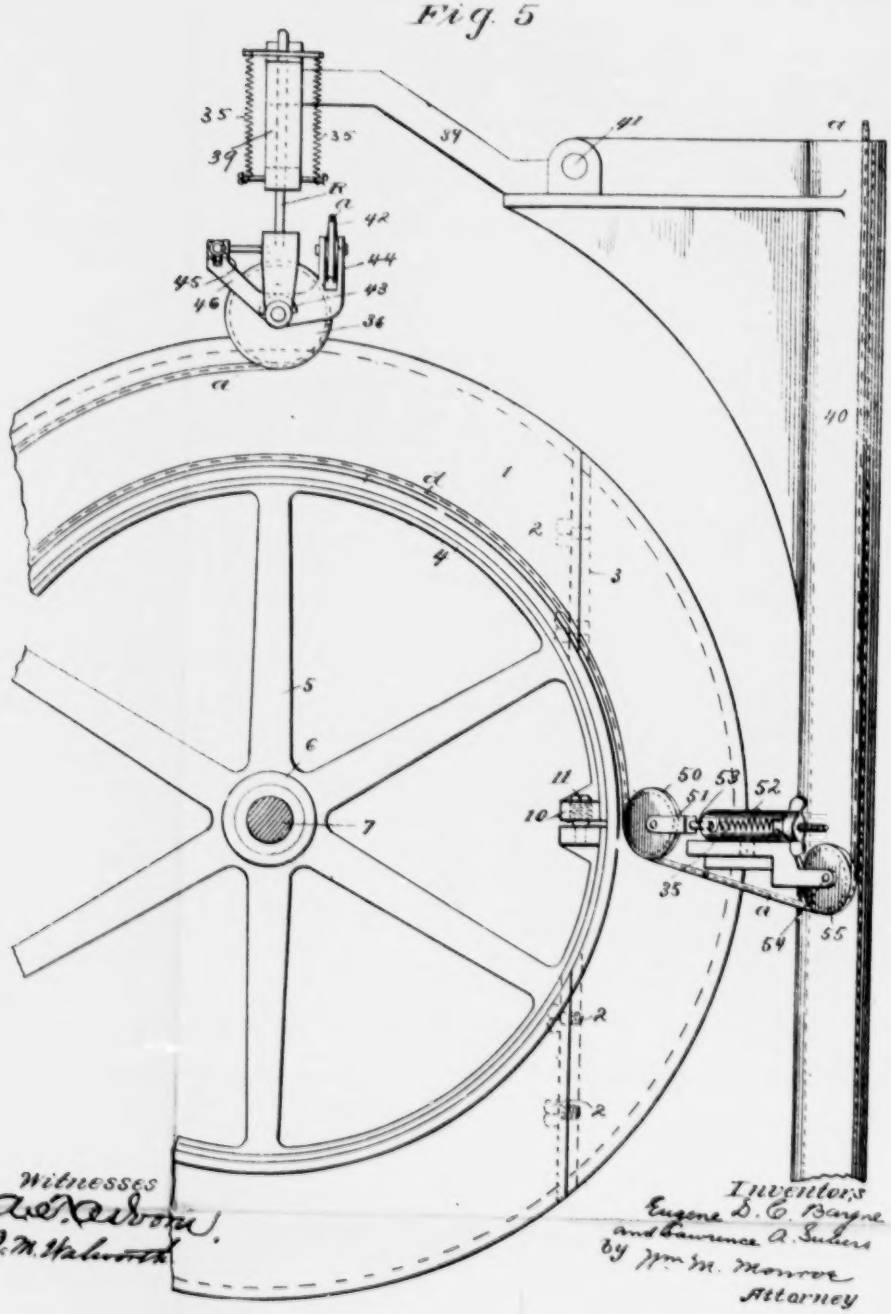
E. D. C. BAYNE & L. A. SUBERS.

AUTOMOBILE TIRE WINDING MACHINE.

APPLICATION FILED NOV. 19, 1906.

4 SHEETS—SHEET 4.

Fig. 5



Witnesses
A. D. Kilbourn.
C. M. Halsworth.

Inventors
Eugene D. C. Bayne
and Lawrence A. Subers
by Wm. M. Monroe
Attorney

UNITED STATES PATENT OFFICE.

EUGENE D. C. BAYNE AND LAWRENCE A. SUBERS, OF CLEVELAND, OHIO.

AUTOMOBILE-TIRE-WINDING MACHINE.

No. 847,041. Specification of Letters Patent. Patented March 12, 1907.

Application filed November 19, 1906. Serial No. 344,094.

To all whom it may concern:

Be it known that we, EUGENE D. C. BAYNE and LAWRENCE A. SUBERS, citizens of the United States, and residents of Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Automobile-Tire-Winding Machines, of which we hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in machinery for winding pneumatic-tire cases and inner tubes, and is designed to overcome the inherent difficulties in laying the thread (which enters into the composition of the tire) circumferentially therein, and thereby provide a form of tire-casing and tube therefor which will be capable of resisting all circumferential and tangential strains and have an accordingly increased efficiency and durability in use.

The invention comprises a rotatable, detachable, collapsible, and highly-polished metallic tire-frame having a cross-section similar to that of the tire and upon which the circumferentially-laid thread is wound; also instrumentalities for applying the thread closely to the wheel-surface as the tire-frame is rotated upon its axis, and automatically-operating mechanism for feeding the thread in closely-approximated rows upon the tire-frame surface, so that the several strands shall adhere together and form a uniform coating or layer thereon.

Furthermore, the machine is designed for use in winding the form of tire described in an accompanying application for a patent, in which a layer of transversely-laid thread is alternated with a layer of circumferentially-wound thread, and each thread is enveloped in a tube or solid coating of insulating and preferably vulcanizable material, which at the time of winding has an adhesive surface, so that as the threads are successively wound upon the surface of the tire-frame they will adhere together and the completed fabric or tire will form an integral or unitary structure, and when vulcanized a perfect vendible tire of heretofore unattainable strength and resistance to circumferential and transverse stresses is thus obtained.

The invention also comprises the detachable, collapsible, and highly-polished metallic tire-frame, the various instrumentalities for guiding and feeding the thread, and means for automatically adjusting the positions of the thread guiding and applying instrumentalities, and the various means for preparing and feeding the prepared thread to the machine and the combination and arrangement of the various parts and construction of details, as hereinafter described, shown in the accompanying drawings, and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is a front elevation of the device, showing the rotatable tire-frame, its support, and the positions of the various thread-guiding and thread-applying devices and the means for preparing the thread. Fig. 2 is a side elevation thereof. Fig. 3 is a plan view thereof. Fig. 4 is an enlarged sectional view showing the upper part of Fig. 1. Fig. 5 is an enlarged view of the upper part of Fig. 2. Fig. 6 is a transverse section of tire-frame on center line, showing the thread-laying rollers or director-wheels which apply the thread to the laterally-extending flange of the tire-frame, which corresponds to the clencher portion of the tire. Figs. 7 and 8 are detail views in plan and elevation of one of the director-wheels, by means of which it is applied to its exact position upon the tire-frame. Figs. 9 and 10 are similar views of one of the thread-guiding wheels. Fig. 11 is an enlarged detail of one of the director-wheel holders, by means of which the sides of the tire are wound. Fig. 12 is a similar view of the balanced holder for the thread surface of the tire. Figs. 13 and 14 are detail views of the receptacles, draw-tubes, and air-passages through which the cord passes to the machine in its insulated form.

In the figures, 1 is a detachable, collapsible, and highly-polished metallic tire-frame upon which the threads forming the tire casing or tube are wound. This tire-frame is divisible into four sectional parts attached together by means of the bolts 2, passing through flanges 3, so that the completed tire casing or tube can readily be removed. This sectional tire-frame is mounted upon the periphery of the wheel-rim 4, which is supported by means of arms 5 and hub 6 upon a driving-shaft 7, mounted in bearings 8 on a suitable frame 9. The rim is made expansible to securely clamp the tire-frame thereon by means of the slotted opening 10 therethrough and a connecting or expanding bolt or bolts

11, by means of which the edges of the slot can be forced apart, and thus employ frictional contact under pressure to retain the tire-frame in position.

In order to make the removal of the tire-frame convenient, the shaft upon which the wheel-hub 6 is mounted is divided within the hub or adjacent thereto, as at 12, and the outer bearings 13 and frame 14 are slidably mounted upon guides, such as the rods 15, upon the common bed-plate 16, so that the outer bearings and outer portion of the shaft can be moved to permit of the removal of the tire casing or tube.

Means for rotating the tire-frame are shown, as cranks 17, upon each end of the shaft; but we do not limit ourselves to the identical forms of construction of this or other portions of the machine, since other equivalent means can be employed to obtain the desired results and lie within the spirit of the invention.

The two portions of the shaft rotate in common, and a tongue upon one portion is shown entering a groove in the other portion with this object in view.

Upon each side of the vertical center of the tire-frame are shown the director-wheels 19 19, over which the prepared insulated threads A, having a perfectly cylindrical and compressed surface, are designed to run, and which apply the threads directly to the surface of the tire-frame upon the sides thereof, commencing at the inner edge or angle 20 and build the thread A in a constantly-increasing spiral wind with the incasing insulation of each row of threads in contact until a position is reached at 21 at approximately an angle of thirty degrees to the axis of the tire-frame. These threads being incased in adhesive material immediately adhere together and to the transversely-laid layer 22 of similar thread below and retain their position without difficulty, and being of perfect shape and having a carefully-adjusted regular upward movement fit immediately into their places without possible distortion or danger of overlapping of the separate strands.

The upward movement of the winding or director wheels is automatically accomplished, and this movement and the means for obtaining such slight lateral movements under control as may be necessitated by the flaring or out of vertical shape of the tire-frame sides may be described as follows: The director-wheels are pivotally mounted within the forks 23, which pass through squared openings in the supports 25. The fork-stems are also angular, so as not to rotate in these openings. These supports are vertically movable upon guide-rods 27 27, fixed in the platforms 28 28, which are mounted upon the frame portions 9 and 14.

The supports for the director-forks and director-wheels are slowly raised to correspond to the diametrical increase in the size of the spiral winds by means of the right and left screw-threaded vertical shafts 29 29, which pass through corresponding nuts 30 in the supports, and these shafts are rotated in conjunction with the shaft by means of the connecting bevel-gears 31 and 32 and the movements are accurately proportioned and the pitch of the screw so regulated as to raise the platforms 28 28 and the director-wheels 19 19 carrying the thread upon the periphery of the tire-frame exactly one diameter of the thread at each revolution of the tire-frame.

The forks can be set to limit their inward travel by means of screw-threads 33 upon their outer ends and nuts 34 engaging their supports. Springs 35, connecting the forks and supports, force the director-wheels into constant contact with the tire-frame, so that the thread is directly applied thereon and cannot get out of position and also provide sufficient elasticity to permit of lateral movement to the required degree. Guide-wheels 35ª serve to direct the thread to the director-wheels.

Clutch levers and rings 60 and 61 engage the bevel-gears 32 on the shaft 7 and throw the gears to stop the action of the right and left hand screws 29 29 as soon as the threads have been wound sufficiently high on the tire-frame to permit the winding of the crown portion thereof, and the director-wheels meet closely and the thread is moved from one to the other by hand.

As soon as the sides of the tire-frame are wound full up to the angle suggested other director-wheels 36, arranged to engage each side of the center of the crown on the tread-surface of the tire-frame, are employed to continue the winding of the threads to the diametrical central plane of the tire-frame. These wheels are mounted upon a horizontal rod 37, upon which they are free to move laterally, and this rod is mounted in a wide fork 38, which is adjustably supported for vertical movement in the head 39 by means of spring-pressed rods R. The head is attached to the standard 40 by means of a pivot 41, which enables the head and attached fork and director-wheels to be lifted while removing the tire casing or tube.

It will be seen that as one thread is laid after the other the director-wheels 36 will readily move toward each other until they completely fill the tread on the crown portion of the tire-frame—that is, the grooves in the director-wheels 36 follow the insulated threads as they are laid, and hence the wheels move toward each other as the rows of thread increase in number until the flat sides of the two director-wheels engage at the center of the crown.

Guide-wheels 42 42 are employed to guide the threads to the director-wheels, and since they must move with the director-wheels

each guide-wheel is mounted in an arm 44, attached to a central hub 43, which is in turn provided with a semicircular flange and groove 48, which is engaged by an annular flange 49 upon the hub of the director-wheel, so that the director-wheel will move the guide-wheel arm as it travels. To prevent the guide-wheel from tipping, a second arm 46 is provided with a roller 45, which runs upon a horizontal rod 47, mounted upon the fork 38.

The highest path of each side-winding director-wheel and the lowest path of each crown director-wheel come so closely together that the thread will almost run from one to the other. However, the thread is placed in position in the proper guide when the exact position of transfer is attained and the machine is not necessarily stopped to permit this transfer if run slowly.

The devices for winding the thread upon the lateral extension E of the tire-frame are seen to be operated simultaneously on each side thereof and comprise director-wheels 50, pivoted in spring-controlled forks 51, which move longitudinally in supports 52 and the stems 53 are squared to prevent them from turning. Upon these supports are also rigid forks 54, in which are pivoted the guide-wheels 55, by means of which the threads are brought to the director-wheels. These supports 52 are pivoted for lateral swinging movement upon the arms 56, which are attached to the same standard which supports the director-wheels 36 36 above. One of these arms is hinged at 57 so that it can be turned away from the tire-frame when the tire casing or tube is to be removed.

The director-wheels first place the thread in the innermost angle at 20, and thence the pressure of the adjacent thread will cause the directors to lay the thread smoothly in outwardly-widening circles until the edge is reached.

Since the groove in each director-wheel 50 will follow the insulated thread as it is laid and as the rows of thread extend farther from the center of the frame, the director-wheels follow the widening circles and the springs maintain an elastic pressure of the director-wheels upon the threads. The springs 35 readily permit of this action.

An essential portion of the device is found in the instrumentalities for coating the thread with the tubular insulation, since the thread thus coated is too sticky to be wound upon spools or spindles and must come directly from the bath and formers to the tire-frame. This device is specifically represented in Figs. 13 and 14 and comprises a series of receptacles, such as P and P', filled with a solution of insulating material, such as rubber, through which the thread passes. Each receptacle is provided with a vertically-extending tube T, preferably of funnel shape, through which the thread passes. The tubes are graduated in size, and after the thread has received its first coating in the upper tube it passes through a box or conduit C, through which a drying-current of air passes, and when thoroughly dried the thread passes through the lower receptacle P' and through second tube T' of slightly larger diameter than the first tubes T, which increase the thickness of the coating materially. A second drying-current of air is passed through the conduit C, then dries the coating thoroughly, although the sticky surface is still retained. The tubular coating upon the thread is then molded and compressed into a perfect cylindrical form while still plastic and by means of rollers S and S', which are designed to draw the thread centrally through the tubes at a speed equaling the speed of the machine, so that the thread will not be under any undue tension when applied to the tire-frame. In this manner a perfect tire-casing or tube can be wound with circumferential and transverse layers of thread, which are not at any time in direct contact, and hence have no frictional bearing upon each other. The layers of transverse thread can be introduced at any time most convenient in the course of the winding. The transverse layers of thread can be introduced by hand upon the tire-frame in the path of the winders, so that one continuous action will wind the complete wheel.

We believe ourselves to be the first to wind a pneumatic tire-case and inner tube with threads in a circumferential manner by means of a collapsible circular frame and automatically-operating mechanism adapted to apply the thread thereto and also to apply a thread having a tenacious surface thereto or to a tenacious coating thereon under elastic pressure. It will be observed that while the springs upon the director-guides serve to permit of lateral and vertical movement under control of the threads they also provide a continuous pressure thereto, which forces the threads into their exact position relative to each other and assists in producing a regular and even wind, as well as compelling the threads into a more intimate contact, so that their contacting surfaces will adhere closely together.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a machine for circumferentially winding insulated thread to form a tire-casing or tube, a circular frame separable into component portions, a rotatable support to which the tire-frame is detachably secured at its inner edge, a shaft on which said rotatable support is secured, and means for rotating the shaft, substantially as described.

2. In a machine for the purpose described, a rotatable tire-frame, said tire-frame being

divisible in sections, a rotatable support upon which said tire-frame is mounted, said tire-frame being detachable from said support, a shaft having a separable portion upon which said support and tire-frame are mounted, and bearings for each portion of said shaft, the bearings for said separable portion of said shaft being movable toward and from said tire-frame and support, substantially as described.

3. In a machine for the purpose described, an annular rotatable tire-frame formed in separable portions, a rotatable support therefor to which the tire-frame is detachably secured at its inner edge, a shaft on which said tire-frame and support are mounted, means for rotating said shaft and instrumentalities for applying a thread insulated with adhesive material to all parts of the surface of said tire-frame, as said tire-frame rotates whereby said insulated thread is wound circumferentially thereon, substantially as described.

4. The combination with a rotatable collapsible tire-frame and a pivotal support therefor, of means for rotating said tire-frame and instrumentalities for applying threads insulated with an adhesive substance simultaneously to the crown and side surfaces of said tire-frame as said tire-frame rotates, whereby said insulated threads are circumferentially wound thereon, substantially as described.

5. The combination with a rotatable tire-frame having sides and tread and lateral surfaces and a pivot-support therefor, of means for rotating said tire-frame, instrumentalities for applying thread insulated with adhesive material directly to the sides of said tire-frame, instrumentalities for applying similar insulated thread to the tread portion thereof, and instrumentalities for applying thread similarly treated to the lateral surfaces thereof, whereby a unitary surface is produced, substantially as described.

6. In a machine for the purpose described, the combination with a separable rotatable tire-frame, of a rotatable wheel having an expansible rim upon which said tire-frame is mounted, a supporting-shaft therefor interlocking extremities for said shaft, fixed bearings for one portion of said shaft and movable bearings for the other portion of said shaft and means for rotating said shaft and tire-frame and tire-frame support, substantially as described.

7. The combination with a rotatable tire-frame, having side, tread and lateral surfaces adapted to receive circumferentially-wound insulated threads, and a pivotal support therefor of means for rotating said tire-frame, director-wheels positioned and arranged upon each side of said tire-frame, by means of which insulated thread is applied to the aforesaid surfaces of said tire-frame, and instrumentalities for obtaining lateral and vertical movements for the director-wheels, substantially as described.

8. The combination with a rotatable tire-frame on which circumferentially-laid insulated threads can be wound and means for rotating the same, of director-wheels over which the insulated threads are applied to the tire-frame, supports for said wheels, means for supplying said wheels with elastic pressure and guide-wheels on said supports adapted to lead the insulated threads to said director-wheels, substantially as described.

9. In combination with a rotatable tire-frame having tread and side and lateral surfaces, and a pivotal support therefor of means for rotating the tire-frame, grooved spring-pressed directors adapted to apply the insulated thread to the aforesaid surfaces, supports for said directors, and means for giving a radial movement to the directors which apply the insulated thread to the sides of the tire-frame, said movement controlled by the said means for rotating said tire-frame, substantially as described.

10. In combination in a machine for the purpose set forth, a rotatable tire-frame having a crown, sides and lateral extensions, a shaft and rimmed wheel on which the tire-frame is mounted, spring-pressed director-wheels in engagement respectively with the crown, sides and lateral extensions of said tire-frame, and arranged to apply an insulated thread directly thereto in a circumferential wind and automatically-operating mechanism for radially moving the side-winding director-wheels to correspond to the increasing diameter of the wind, substantially as described.

11. In combination in a machine for the purpose set forth, a rotatable tire-frame having a crown and side portions, an operating-shaft therefor, director-wheels and supports therefor adjacent to said tire-frame and on both sides thereof, adapted and arranged to engage the respective surfaces of crown and side portions, the supports for the director-wheels for the side portions having screw-threaded openings, screw-threaded shafts passing through said screw-threaded openings in said supports, and a geared connection between said screw-threaded shafts and the said operating-shaft, substantially as described.

12. In combination, in a machine for winding insulated threads circumferentially to form a tire-casing or tube, a rotatable and separable tire-frame having crown, side and laterally-extending portions, a rimmed wheel on which the tire-frame is mounted, a divided shaft therefor, bearings for said wheel, a bed-plate upon which said bearings are mounted, one set of said bearings being movable thereon, a pair of director-wheels for said thread adapted to engage the crown portion of said

tire-frame and to move together as said cord is laid, a pair of director-wheels adapted to engage the side portions of said tire-frame and move diametrically outward as the thread is wound, a common support for the said crown-engaging wheels, said support mounted on said bed-plate, supports for said side-engaging wheels, said supports mounted in guides for radial movement relatively to said tire-frame, and having screw-threaded openings therein, and screw-threaded shafts passing through said openings and geared connections for said shafts and divided shafts, substantially as described.

13. A support for a pair of director-guides for the purpose set forth, consisting of a standard, an arm pivoted thereon, vertical rods spring-pressed and arranged for vertical movement in said arm, a fork to which the lower ends of said rods are secured, a horizontal rod in said fork, upon which said director-wheels are loosely mounted, a semicircular hub for each wheel, in which said wheel rotates said hub having arms a guide-wheel in one of said arms, and a roller in the other, and a horizontal rod on said fork, on which said roller runs, substantially as described.

14. In combination with director-wheels, adapted to wind the crown-surface of a tire-case or tube, a horizontal rod on which said wheels are mounted, a support for said rod, an arm to which said support is adjustably secured for vertical movement, a guide-wheel for each director-wheel, said guide-wheels being arranged to move in unison with said director-wheels, substantially as described.

15. The combination with a collapsible and rotatable tire-frame, formed in detachable portions, having a coating of tenacious fabric thereon, of automatically-acting instrumentalities for applying a circumferential wind of thread thereon under elastic pressure.

16. The combination with a collapsible and rotatable tire-frame, of a rotating device for applying a circumferential wind of thread having a tenacious surface thereupon under elastic pressure.

17. The combination with a collapsible annular tire-frame, formed in detachable portions, of an expansible wheel-rim upon which said frame is detachably secured, and means for rotating said wheel, substantially as described.

In testimony whereof we herewith set our hands this 17th day of November, 1906.

EUGENE D. C. BAYNE.
LAWRENCE A. SUBERS.

Witnesses:
A. T. OSBORN,
C. M. WOLWORTH

Defendant's Exhibit O, Mathern German Patent.

Translation.

GERMAN PATENT No. 206,197.

Class 63*c*. Group 10.

ALPHONSE MATHERN, BERLIN.

Machine for the Mechanical Production of Shoes for Pneumatic Tires.

Patented in the German Empire from December 20, 1906.
Published January 26, 1909.

The subject of the invention is a machine for the mechanical manufacture of shoes for pneumatic tires. Such machines in which the fabric to be wound around the tire core unwinds in the shape of a strip from a drum and is stretched in its middle part by curved rollers are not new. The novelty consists in the fact that the edges of the fabric are laid in uniform folds by means of two bevel wheels and thereby shortened. The curved part of the fabric is then pressed against the core ring by radially reciprocating rolls. The edges of the fabric, on the other hand, are pressed against the core ring by the step-wise arranged rolls and a sector moving back and forth in the direction of the periphery, whereby the folds are removed.

In the accompanying drawing a form of construction of the machine and the different tools required are shown, fig. 1 being a side view, fig. 2 a plan, and fig. 3 a section on line A-B of fig. 1. Fig. 4 is a section on line C-D of fig. 1. Figs. 5, 6 and 7 show in elevation, plan and transverse section respectively the tool used to put on the beads. Fig. 8, finally, is a transverse section of a tire shoe made by means of the machine.

The machine is mounted on a cast-iron frame 1 fitted with two lateral uprights 2 designed to carry the guides

and bearings for the movable parts. The cone pulley 3 with gears 4 secured thereto drives the wheel 5, which by means of the gear 6 transmits the movement to a wheel 7 keyed on the shaft 11. Said shaft 11 by means of gear 8 drives the wheel 9 mounted on the shaft 12. To the shaft 12 the shaping core 10 is secured, which rotates with the shaft 12 at a speed sufficient to wind the canvas on the core and fit on the rim beads and tread.

The cone pulley 3 is loosely mounted on its shaft, but may instead be connected with the shaft by a coupling. Gears 5 and 6 are arranged on an eccentrically mounted shaft 13 and are capable of being displaced laterally by means of the adjusting device 34. When this has been done and the cone pulley has been coupled with its shaft the gear 8 mounted on said shaft directly drives the shaft 12 by means of the wheel 9, and thus sufficient speed of the shaping core is insured to remove the folds from the canvas on the core, to trim said canvas, to rub off the finished skeleton, etc.

The shaft 12 is fitted with a claw coupling 15 by means of which it may be rendered independent of the wheel 9. The shaft thus rotates freely, and the core ring may be turned by hand in any direction, either for the purpose of inspecting the work or of cleaning the canvas. On the shaft 12 a sliding member 16 is mounted in which moves vertically a slide 17 forming the tool holder and designed to receive the tools required for the different operations.

The canvas is wound on a wooden drum 18 which is fitted with adjustable lateral disks 19 for the different widths of the canvas which may be used. Said wooden drum is mounted on a shaft 20 which is square at this point but round over the remainder of its length. Said shaft 20 carries a drum 21 on to which wind steel bands which are tightened at one end by the screw 22 and the hand wheel 23 and held in position, at the other end, by a tension spring 24.

The shaft 20 is capable of being pushed forward and backward transversely to its axis according to the diameter of the tire to be made. To that end said shaft is mounted in two sliding bearings 25 provided on the lateral uprights 2.

The different pieces of canvas are put on the core 10 in the following manner:

The shaft 20 rotatable in the two bearings 25 carries, as previously stated, the canvas drum 18. As the canvas unwinds from the latter it is brought between two spherical or oval friction rollers 26, which are so arranged as to exert a rotary action on the middle part of the canvas whereby the formation of puckers at this point is rendered difficult. To the same support are fitted on each side two toothed bevel wheels 36, the object of which is merely to cause uniform puckering at the edges of canvas whereby a slight drawing back of the canvas at all points is insured from the outset. From there on the canvas is wound on the core 10 then coated with a caoutchouc solution to cause it to adhere firmly to the core and follow the rotary movement of the latter.

The spool 18 is held in its rotary movement by a brake band which acts on the cast-iron drum 21. By rotation of the hand wheel 23 tension is exerted on the bands 27 of the drum 21. The end of said bands is held in position by a spring 24, the tension of which is adjusted accordingly. It thereby becomes possible to stretch the canvas in a perfectly uniform manner more or less, according to the profiles to be produced by the machine.

On the rotating core 10 the canvas first reaches the rolls 30 which are so mounted as to reciprocate in the casing 28. The latter contains a cranked vertical shaft 33 which moves the slide 32 guided in the walls of the casing 28.

To said slide 32 are rotatably fastened two links 31

carrying at their ends rolls 30 which move back and forth over the core and thereby press the canvas just laid on the core against the straight or curved sides. When the core has made a complete rotation passing through said rolls 30, the casing 28 is pushed back on the guide 34. Then the speed of rotation of the machine is changed by bringing the cone pulley 3 into engagement with the shaft 11 and pushing aside the gears 5 and 6.

Thereupon the apparatus (sector) 29 shown in figs. 1 and 3 is brought into operation. It consists of two rows of pressure rolls 38 arranged stepwise, which have different peripheral velocities, and which by reason of their reciprocating movement admit of the progressive adhesion of the canvas without compelling the core 10 to make more than one rotation.

The various mechanisms may be driven in a manner different from that described above.

The rolls and disks may be fitted to any part of the core provided only that the movement of the same is effected in the manner indicated.

To fit the beads 40 (fig. 8) on the rim two pressure rolls 41 and 42 (figs. 5 to 7) are used. The pressure roll 41 seized the bead 40 from below, and the smaller roll 42 presses against it laterally. The periphery of the beading strip 40 is glued to the canvas by a slight pressure of the hand. To enable the beads to be placed very accurately in position there are provided in the sides of the roll-holder 43 guide holes 45 having the cross-sectional shape of the beads or inserts 40 to be put in position.

After the bead 40 has been introduced from the back into the guide hole 45, the two rolls 41 and 42 press against the core 10, and the latter upon its rotation carries the bead 40 along with it; the latter enters its guides, is thereby brought under the disks and accurately and quickly placed in position.

CLAIM

Machine for the mechanical manufacture of shoes for pneumatic tires in which the fabric to be wound around the tire core unwinds in the shape of a strip from a drum and the middle part of the same is stretched by curved rollers, characterized by the fact that the edges of the fabric are laid into uniform folds by means of two bevel wheels (36) and thereby shortened, whereupon the curved part of the fabric by means of radially reciprocating rolls (30), and the edges by means of the stepwise arranged rolls (38) of a sector (29) moving back and forth in the direction of the periphery, are pressed against the core ring (10).

Fig. 1.

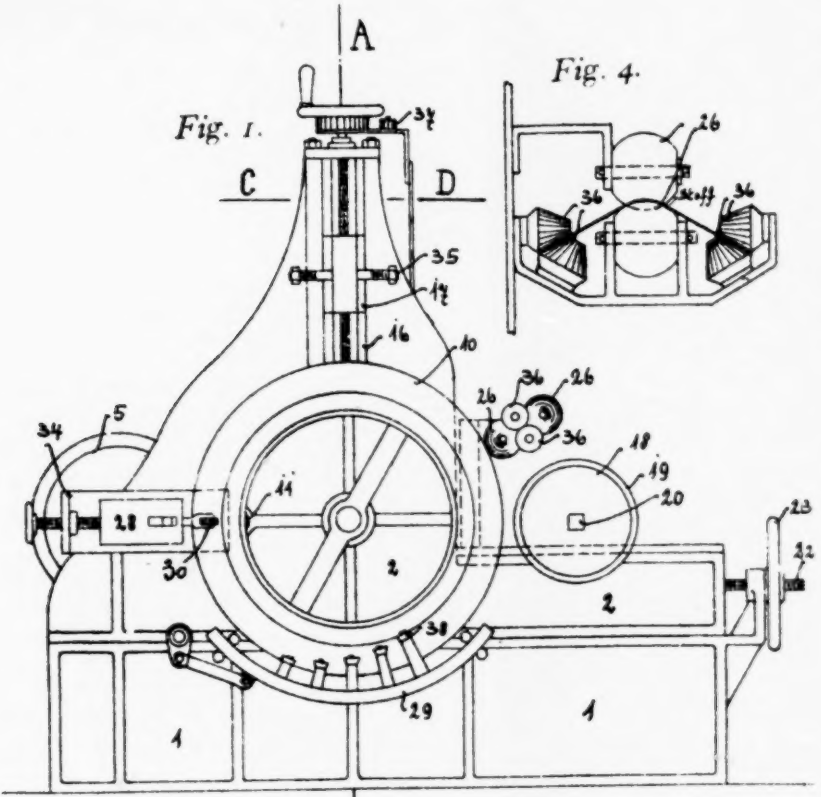


Fig. 4.

Fig. 2.

PHOTOGR. DRUCK DER REICHSDI

Fig. 3.

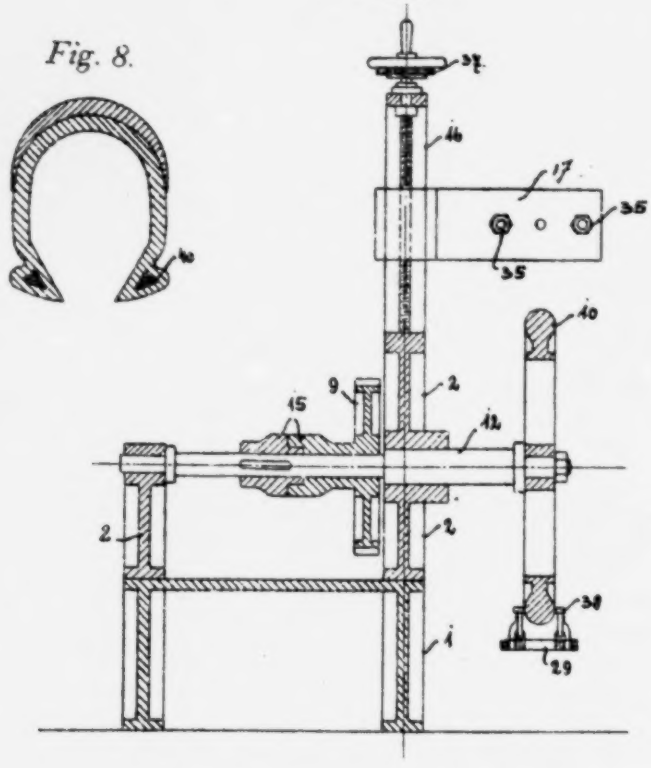


Fig. 8.



Fig. 5. Schnitt G-H.



Fig. 6.

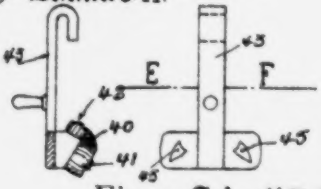


Fig. 7. Schnitt E-F



Zu der Patentschrift

№ 206197.

R REICHSDRUCKEREI

Defendant's Exhibit P, Hernandez Patent.

Translation.

FRENCH PATENT No. 395,812.

X. Transportation on Roads.

1. Vehicles.

MARTIN HERNANDEZ, France.

Machine for the Manufacture of Pneumatic Tires. Date of application, January 7, 1908; of delivery, January 8, 1909; of publication, March 19, 1909.

(The delivery of this patent has been delayed in pursuance of art. 2, sec. 7, of the law of July 5, 1844, amended by the law of April 7, 1902.)

This invention which relates to a machine enabling pneumatic tires to be manufactured automatically is shown in the annexed drawing, in which:

Fig. 1 is an elevation of the entire machine;

Fig. 2 is a corresponding plan;

Fig. 3 is a front elevation of the frame on which the shaping core is placed;

Fig. 4 is a rear view of said frame showing the driving means;

Fig. 5 is a plan corresponding to figs. 3 and 4;

Figs. 6 and 7 finally show on a larger scale details of the shaping tools.

This machine consists of a frame a of iron or pig iron (figs. 3, 4 and 5) supporting a shaft a^1 which rotates in bearings and on which is suitably mounted an expandor consisting of a hub b fitted with three arms b^1 carrying lugs or stops b^2 on which is mounted a band or rim c through which pass three regulating screws c^1 designed to center the core d, which may be of different

diameters and which serves to give the required shape to the tires to be produced. The speed of rotation of said core, which is about a rotation per minute, is transmitted by a pulley a^2 (figs. 4 and 5) mounted on the end of a shaft a^1 by the side of a loose pulley.

The canvas x designed to produce the tire or tires on the core d is brought upon the latter by rollers mounted in a frame e. The roller e^1 on which the canvas is wound carries on its shaft, outside of the frame e, a grooved pulley e^2 with counterweight e^3 which enables the necessary tension to be insured. The canvas x coming from the roller e^1 passes over the intermediate roller e^4 which waves it as it passes over it and compels it to take up a larger part of the periphery of the roller e^5 over which it passes next, which insures a better shape of the canvas when the roller e^5 presents it to the core d.

At that moment when the canvas x reaches the core d it is subjected to the action of the different members designed to give it the shape of a pneumatic tire. To that end there is conveniently provided an iron or pig iron frame f carrying slides g and h on which travel carriages i and j. (The drawing shows only two of these elements of which there are in reality four identically alike.) The carriage i is capable of being displaced from the smallest to the largest diameter of the core. The carriage j is capable of being moved from the smallest to the largest cross-section of the core.

The carriage i is fitted with a circular tool holder formed of two plates, i^1, i^2 joined together by bolts. Between said two plates i^1, i^2 are secured six tubes i^3 (figs. 2 and 6) in which slide rods i^4 carrying at their ends rolls i^5. Said rods i^4 carry a screw i^6 sliding in a groove i^7 provided on the tube l^3 and serving to guide them, and are moreover subjected to the action of a spring i^8 which is located in the bottom of the tube i^3 and the object of which is to give them the necessary resiliency to cause

the canvas x, by means of the rolls i^5, to assume the form of the cord d and thus insure the shape of said canvas.

In fig. 6 one of the rods fitted with rolls is shown in the position before effecting the work of shaping, and the other in the position during such work.

The circular tool holder consisting of the plates i^1, i^2 is driven by a pulley i^9, which imparts to it a speed of about thirty revolutions a minute, which is sufficent to insure good results.

The tool holder carriages i are designed exclusively to shape the canvas from y to y^1 before the bead is put on, and from y to y^3 after the bead has been put on.

The carriage j (figs. 2 and 7) is fitted with a straight tool holder j^1, in which move four rods j^2 carrying respectively rolls j^3, j^4, j^5 and a cutter j^6. Said roll rods and knife are controlled by the action of two springs j^7, j^8 designed to give them resiliency and facilitate the shaping of the bead. Such resiliency may be reduced or increased at will by means of the set screw j^9. The cutter j^6 is designed to trim off the excess of canvas which may be outside of the base of the bead.

The object of the rolls j^3, j^4 and j^5 is to shape respectively the hook of the bead, the top of the bottom of the bead.

The straight tool holder carriages j^1 are designed to place the bead at proper height, to shape the canvas covering the same, and to trim the latter when they project over the face of the head.

The beads may be triangular, round, or of any other shape, and the rolls j^3, j^4, and j^5 may be given any suitable profile according to the shape to be obtained.

The automatic manufacturer of pneumatic tires refers only to the canvas, the rubber being put on by hand, and it is to be understood that the invention is not confined strictly to the machine illustrated in the annexed

drawing, which may undergo modifications without affecting the principle of the same.

F. P. 395,892.

RÉSUMÉ.

The object of the invention is:

A machine for the automatic manufacture of pneumatic tires of every size and for every kind of vehicles, characterized by a special device so operated as to shape the canvas on a core, while the rubber is put on by hand, to the end of forming such tires.

MARTIN HERNANDEZ,
By L. FRANCKEN, Attorney.

G5919—2

Fig.1

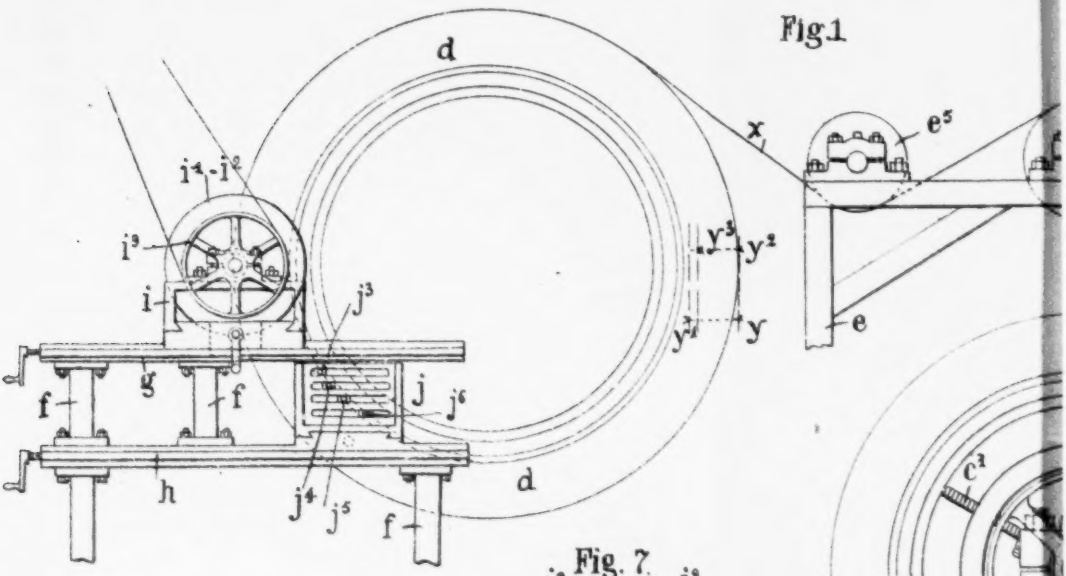


Fig. 7.

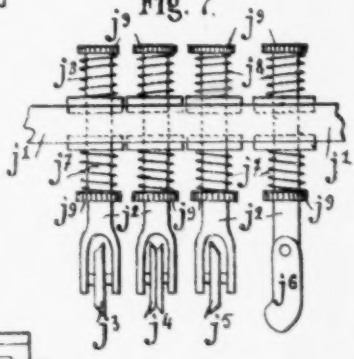
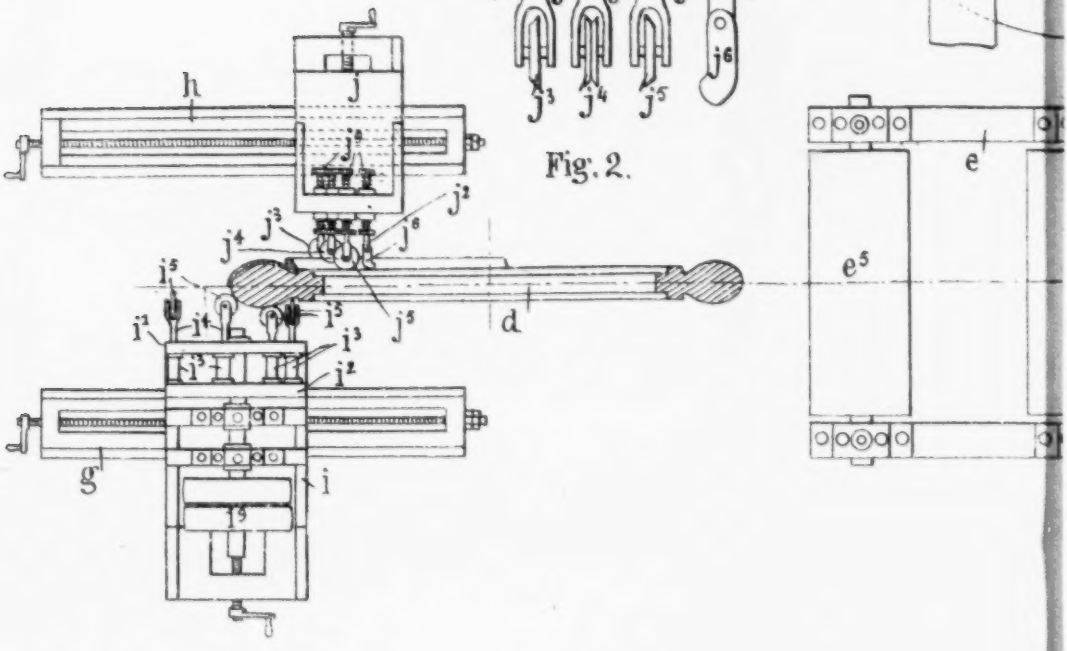
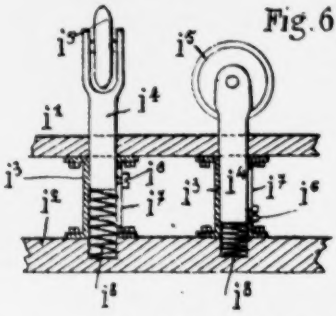


Fig. 2.



Pl. unique

Fig. 6.



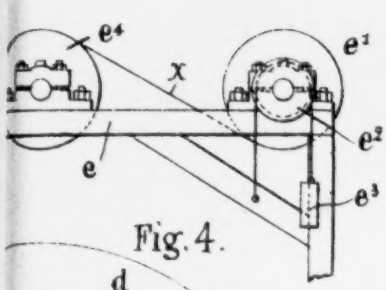
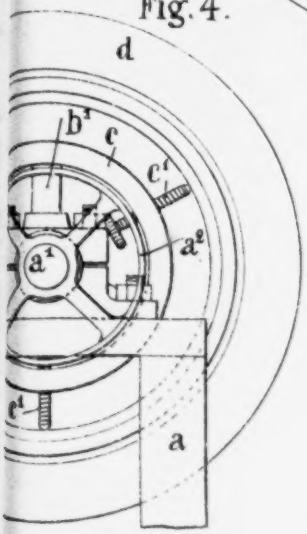


Fig. 4.

Fig. 3.



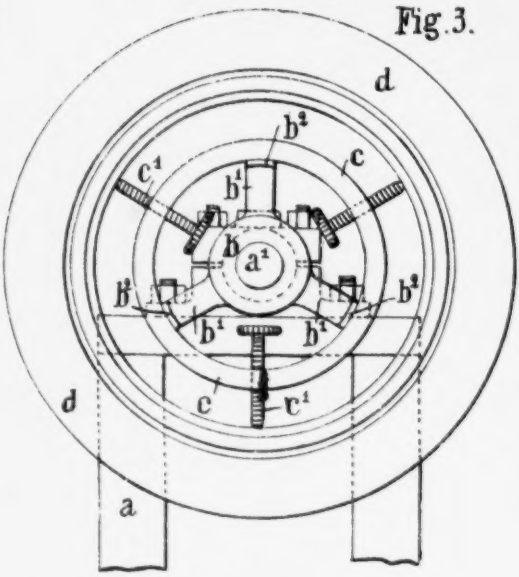
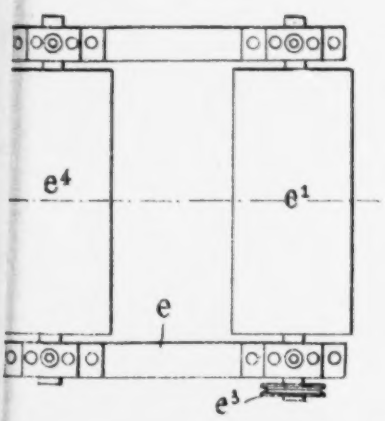
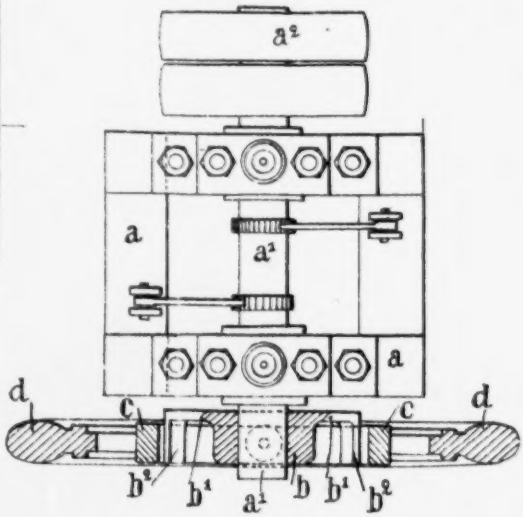


Fig. 5.





Defendant's Exhibit Q—Dewey Patent.

Defendant's Exhibit Q—Dewey Patent.

320

(No Model.)

M. W. DEWEY.

APPARATUS FOR FORMING OR SHAPING SHEET METAL ELECTRICALLY.

No. 438,407. Patented Oct. 14, 1890.

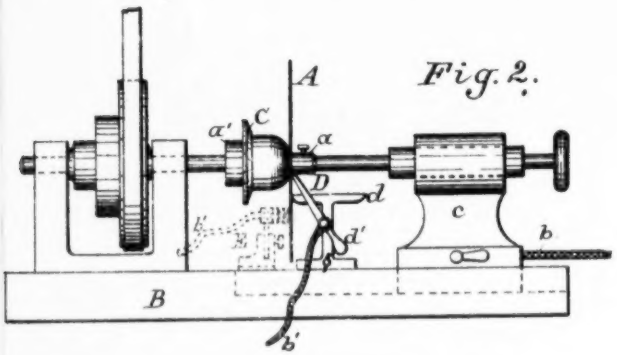


Fig. 2.



Fig. 1.

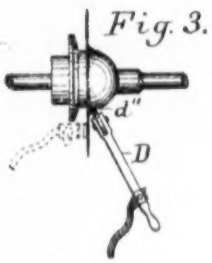


Fig. 3.



Fig. 4.



Fig. 5



Fig. 6.



Fig. 7.



Fig. 8.

WITNESSES:

C. L. Burdick

H. M. Seamans

INVENTOR,

Mark W. Dewey,

BY

Duell, Laass & Duell,

his ATTORNEYS.

UNITED STATES PATENT OFFICE.

MARK W. DEWEY, OF SYRACUSE, NEW YORK, ASSIGNOR TO THE DEWEY CORPORATION, OF SAME PLACE.

APPARATUS FOR FORMING OR SHAPING SHEET METAL ELECTRICALLY.

SPECIFICATION forming part of Letters Patent No. 438,407, dated October 14, 1890.

Application filed July 28, 1890. Serial No. 360,122. (No model.)

To all whom it may concern:

Be it known that I, MARK W. DEWEY, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Apparatus for Forming or Shaping Sheet Metal Electrically, (Case No. 67,) of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to certain apparatus for use in my process or method of forming sheet-metal articles which requires the employment of heat to soften or anneal the metal, and the application of pressure to gradually conform the sheet to the surface of a suitable die or mold.

Articles have been manufactured from sheet metal heretofore by successive and graduated pressing, depending on the depth of the article, and in some cases the metal was annealed after each pressing, as such pressing operation rapidly hardened it, which in turn caused the metal to tear and crack. Some metals, as German silver, are too brittle to be pressed to a great extent by this method. The process depends for its success upon the malleability of the metal; and it is the purpose of my invention to keep the metal annealed or in a softened condition during a greater part of if not the entire or complete formation of the article and to decrease the number of molds as well as the number of pressings usually required in forming or shaping the article, and also to save time and handling.

The object of my present invention is to provide apparatus or means for accomplishing my process or method which will produce more durable and superior sheet-metal ware, allow the formation of articles from thicker sheet metal and from various metals heretofore incapable of being pressed.

My invention consists in certain apparatus and devices hereinafter more particularly described and claimed, and useful in practicing the method set forth and claimed in another application for patent filed by me May 17, 1890, Serial No. 352,159; and it consists, essentially, in the combination, with a die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, connections to pass an electric current through the sheet while it is rotated, and means for imparting pressure to the sheet to conform the same to the surface of said die or mold.

My invention consists, also, in certain other combination of apparatus hereinafter described, and specifically set forth in the claims.

In the accompanying drawings, Figure 1 is a side and edge view of a disk of sheet metal to be operated upon. Fig. 2 shows a side elevation of a lathe for holding the disk of sheet metal upon a mold and rotating the same while pressure is applied with an instrument to form said disk to the shape of the mold. Fig. 3 shows a sheet-metal article partly formed over the same mold. Fig. 4 represents the article completed. Figs. 5, 6, 7, and 8 are sectional views of a number of different-shaped articles that may be formed by my apparatus.

Referring specifically to the drawings, A in Fig. 2 is a sheet of thin metal, preferably in the form of a disk, as shown in Fig. 1, mounted upon a lathe B and held by pressure from a head-stock *a* against a mold C of the required form, fixed on the face-plate *a'* of the revolving spindle. The metal sheet may be cut into the form of a disk in any suitable manner either before or after said sheet is placed in position upon the mold in the lathe. The disk is preferably heated by passing a heating current of electricity through the same from a point at or near its center, or where the head-stock *a* bears against it, to the point where the pressure instrument or burnisher D is in contact with it. The pressure-instrument D may be of metal or some suitable non-conducting material. When said instrument is metallic, the current may be circulated through the apparatus, as shown, from the conductor *b* through the back head *c*, spindle, and head-stock *a* to the sheet A, through said sheet to the point where the instrument D is pressed against it, and through the instrument to and through the flexible conductor *b'*, connected therewith, back to a suitable source of electricity, to which both conductors *b* and *b'* are connected.

When the instrument D is of non-conducting material, as bone or wood, or even when metallic, the current may be passed through an adjustable contact or brush E, bearing upon the disk, as shown in dotted lines in the figure. Said contact may be adjusted and moved to any desired position to make and maintain contact with the disk while it is rotated and formed into an article. The conductor *b* is then connected to the contact E, instead of the instrument D. Instead of passing the current through the lathe-spindle, another contact attached to the conductor *b* may be provided to bear upon the disk. The pressure-instrument D is held upon the lathe-rest *d* as a fulcrum, and while the disk A and mold C are revolved said instrument is applied to the disk near the center, which is rapidly bent or swaged, so as to fit close against the curved face of the mold. The instrument D may be held and moved by any suitable means, but preferably in the hand and by the handle *d'*. A gentle pressure is caused to bear on one point, thus producing a slight depression; but as the sheet is spinning at high velocity the depression at once forms a circle, and so by continuing the pressure of the instrument and gradually moving the same the sheet is molded into any form accordingly.

The mold C is preferably made of non-conducting material or of conducting material coated with a non-electric conducting material, as a mineral paint or enamel.

Various forms of pressure instruments or burnishers may be used, the one shown in Fig. 3 being provided with a roll *d''* to decrease the friction between the bearing-points.

Sectional molds are employed when the form of the article, as shown in Fig. 6, will not permit the removal of a solid mold after the article is formed or spun over the mold. It will be also apparent that the sheet of metal may be by this method maintained in a heated, softened, or annealed condition during the entire formation of the article, if desired, and that with suitable current-regulating devices in circuit the sheet may be kept at any temperature desired without danger of burning or heating the sheet metal too much.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric apparatus for forming sheet-metal articles, the combination, with a die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, connections to pass an electric current through the sheet while it is rotated, and means for imparting pressure to the sheet to conform the same to the surface of said die or mold.

2. In an electric apparatus for forming sheet-metal articles, the combination, with a suitable die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, a pressure-instrument to gradually conform the sheet to the form of the surface of the said mold, and terminals of an electric circuit in contact with the sheet, one at its center or axis and the other at a point nearer the edge or periphery of the sheet.

3. In an electric apparatus for forming sheet-metal articles, the combination, with a suitable die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, a pressure-instrument to gradually conform the sheet to the form of the surface of the said mold, and terminals of an electric circuit connected to the sheet, one terminal constituting the headstock of the rotating means and the other terminal the pressure-instrument.

4. In an electric apparatus for forming sheet-metal articles, the combination, with a suitable die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, a pressure-instrument having a revolving bearing to gradually conform the sheet to the form of the surface of the said mold, and terminals of an electric circuit in contact with the sheet.

5. In an electric apparatus for forming sheet-metal articles, the combination, with a suitable die or mold, of means for holding and rotating said die or mold with the sheet of metal to be operated upon, a universally-movable pressure-instrument to gradually conform the sheet to the form of the surface of the said mold, and terminals of an electric circuit in contact with the sheet.

6. In an apparatus for electrically forming sheet-metal articles, the combination of a die or mold, means for holding the sheet against said die or mold, and a movable pressure-instrument to conform the sheet to the shape of the surface of the mold, and electric terminals in contact with the sheet.

7. In an apparatus for electrically forming sheet-metal articles, the combination of a die or mold, means for holding the sheet against said die or mold, and a movable pressure-instrument to conform the sheet to the shape of the surface of the mold, and electric connections leading to said means for holding the sheet against the mold and to the movable pressure-instrument.

In testimony whereof I have hereunto signed my name this 26th day of July, 1890.

MARK W. DEWEY. [L. S.]

Witnesses:
C. H. DUELL,
H. M. SEAMANS.

Defendant's Exhibit R—Early Seymour Patent.

F. J. Seymour.

Spinning Metals.

No 80,836. Patented Aug. 11, 1868.

Fig 1

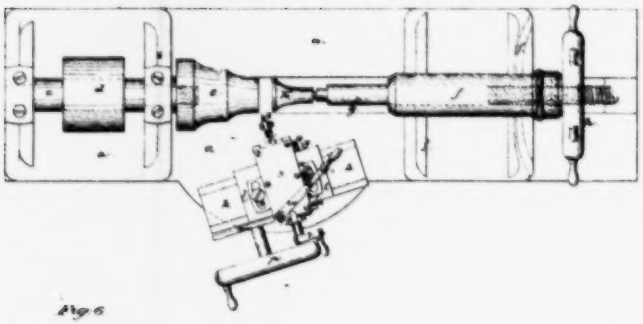


Fig 2

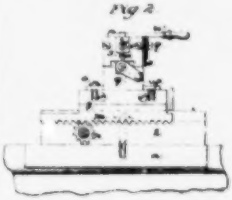


Fig 6



Fig 4

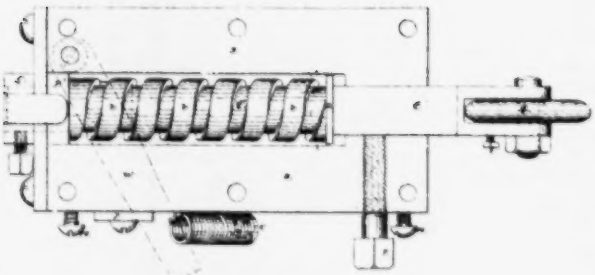


Fig 3

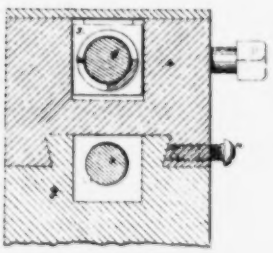
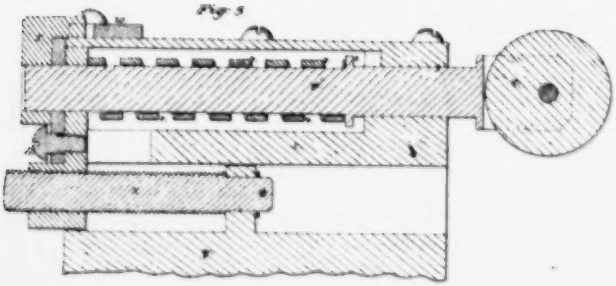


Fig 5



Witnesses
Geo. H. Graves
Chas. A. Seely

Inventor
Frederick J. Seymour
per L. Bradford
Atty.

United States Patent Office.

FREDERICK J. SEYMOUR, OF WOLCOTTVILLE, ASSIGNOR TO HIMSELF AND E. MILLER AND COMPANY, OF MERIDEN, CONNECTICUT.

Letters Patent No. 80,836, *dated August* 11, 1868.

IMPROVEMENT IN MACHINE FOR BURNISHING AND SPINNING METALS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, FREDERICK J. SEYMOUR, of Wolcottville, in the county of Litchfield, and State of Connecticut, have invented, made, and applied to use a certain new and useful Improvement in Machinery for Spinning or Burnishing Articles of Sheet Metal; and I do hereby declare the following to be a full, clear, and exact description of the said invention, reference being had to the annexed drawing, making part of this specification, wherein—

Figure 1 is a plan of my said machine complete.

Figure 2 is an elevation of the tool-holding slide-rest.

Figure 3 is a section of the tool-stock and slide.

Figure 4 is a plan of the tool-stock and slide with the cap-plate removed.

Figure 5 is a longitudinal section of the tool-stock and parts that operate on the same, and

Figure 6 is an elevation of a conical former, that may be used for giving shape to the article to be made in its first stages.

Similar marks of reference denote the same parts.

Machines have heretofore been made for operating upon disks of sheet metal, to spin them up to the shape of a chuck or former, the said chuck or former and the sheet metal revolving against a roller that is held to said sheet metal by a slide-rest, to which motion is given to cause the roller to move along the surface of the chuck or former, as may be seen in the French patent of Japy Brothers, dated March 1, 1836.

The nature of my said invention consists in mechanism for holding a roll or burnisher with a yielding or elastic power against the revolving sheet metal and former, so that the spinning up of articles of sheet metal can be done with a tool that is held by mechanism that will yield to the curvatures of the former or chuck, and operate similarly to the spinning of sheet-metal articles by hand.

By my mechanism, irregular shapes, such as used for lamps, oil-cans, &c., can be spun up with great speed and precision by a workman with but little experience or bodily strength, while the spinning of large articles of sheet metal has heretofore required a workman with considerable experience and bodily strength to hold the tool.

My improvements are adapted to spinning up of regular conical articles in sheet metal, but are more particularly available in spinning up ornamental articles formed with curved sides or angular bends, forming bands or varying-shaped circular articles, now spun up by hand or pressed up in dies.

In the drawing, *a* is the bed of the machine, carrying the head *b*, that supports the mandrel *c*, upon which is a pulley, *d*, driven by competent power.

e is the chuck or former, of the desired shape, corresponding with the interior of the lamp-reservoir or other article to be produced. This former *e* is screwed upon the end of the mandrel *c*, and can be changed as required for different articles, or for different stages of the same article.

f is the movable head, carrying the sliding mandrel *g*, set up by the hand-wheel *h*, to clamp the disk of metal between the clamping-head or whirl *h'* and the former *e*.

Upon the top of the bed *a* is a bed, *k*, forming a slide for the tool-holding mechanism, and this bed *k* may be turned to any desired angle to the centre line of the machine, so as to be parallel, or nearly so, with the general outline of the article to be formed, as illustrated in fig. 1.

The bed *k* is attached by a bolt near the centre thereof, as shown by dotted lines in fig. 2.

Upon the top of the bed *k* are V-slides, receiving the secondary bed, *l*, with a rack, *m*, on one side, acted upon by the pinion *n*, that is moved by the hand-wheel *p*, so that the tool, and the slide-rests carrying the same, can be moved along over the surface of the sheet metal by turning said wheel *p* and sliding the secondary bed *l* along on the bed *k*.

The slide-rest *q* is attached to the secondary bed *l* by the slots and screws *o*, so that it can be secured at

any desired angle to the said bed *l*, for regulating the direction in which the roller or burnishing-tool and its stock stands to the metal operated upon.

The tool-holding slide *s* is fitted to move endwise upon V-slides, upon the rest *q*, and *r* is the screw and handle that operates upon the nut *r'* to move the slide *s*.

The tool *t* is mounted at the end of the stock *t'*, that is fitted to slide endwise through the slide *s*, and within said slide *s* the spring *v* operates, between the upper end of the nut *r'* and a shoulder, 3, to project the tool *t*, but if the pressure upo the tool becomes too great, the spring *v* yields, and allows the tool and stock to move back, and thus the tool is made to follow up the sheet metal, and keep it into contact with the surface of the chuck or former, whatever the shape of that former may be, the parts being properly set to operate in connection with the particular former.

When the tool is to be moved along again to the right, to commence a second operation, the stock *t'* is to be drawn back by the lever *w*, (see fig. 1 and red lines, fig. 4,) acting against a toe that projects from the collar 5, that is attached to the back end of the stock *t'*, and a spring, 6, draws said lever down to latch it behind the catch 7. The raising of this lever to unlatch it, when the tool is opposite the place of beginning on the disk or article of sheet metal, allows the spring *v* to project the tool for proceeding as before.

In burnishing articles of sheet metal, I find it best to use the roll *t*, kept from turning by a set-screw at 8, as a circular burnisher of this character can be kept in order with great facility.

The stock *t'* can be clamped, so that the tool will be rigid, by the screw 9. This may be employed where a straight-sided conical article is being spun up, especially where it is desired to reduce the thickness of the metal during the spinning operation.

If the parts are adjusted to a given movement, and it is desired to make the spring *v* more powerful in its operation, the screws 10 may be tightened to fasten the tool-slide *s* immovably to the slide-rest *q*, and then, by turning the screw *r*, the nut *r'* will compress the spring *v*.

I prefer to use a screw at 11, to hold the nut *r'* back to its place, under ordinary circumstances. This screw 11 is to be slackened or removed when the spring is rendered more powerful by the movement of the nut *r'*.

By the apparatus constructed as aforesaid, the workman is relieved from the labor of holding the tool while the spinning operation is performed, and he is able to guide and direct his tool with precision, in a manner corresponding generally to that employed in turning metals with a slide-rest; and, in addition to the yielding force applied to the tool, to cause it to conform to the shape of the chuck or former, the screw *r* and hand-wheel *p* place the tool under the direction of the attendant, and if the spring *v* is too powerful for any particular character of work, its force may be lessened by the hand acting to draw back the lever *w*.

What I claim, and desire to secure by Letters Patent, is—

1. A revolving chuck or former, in combination with a tool fitted to yield and moved automatically, in spinning or burnishing articles of sheet metal upon said chuck or former, substantially as formed.

2. The lever *w*, in combination with the tool *t*, stock *t'*, and spring for withdrawing said tool from the work, as set forth.

3. The roll *t* and set-screw 8, for converting said roll into a burnisher, as and for the purposes set forth.

4. The arrangement of the tool-holding slide *s*, nut *r'*, screw *r*, and slide-rest *q*, and screws 10 10 10, for the purposes and as set forth.

5. The tool-holding slide *s*, tool *t*, spring *v*, lever *w*, slide-rest *q*, secondary bed *l*, bed *k*, and hand-wheel *p*, arranged and applied substantially as specified, for spinning or burnishing articles of sheet metal upon a revolving chuck or former, as set forth.

In witness whereof, I have hereunto set my signature, this fifth day of May, 1868.

FRED'K J. SEYMOUR.

Witnesses:

W. H. Perkins,

Ebenezer Gilbert.

Defendant's Exhibit S—Later Seymour Patent.

328

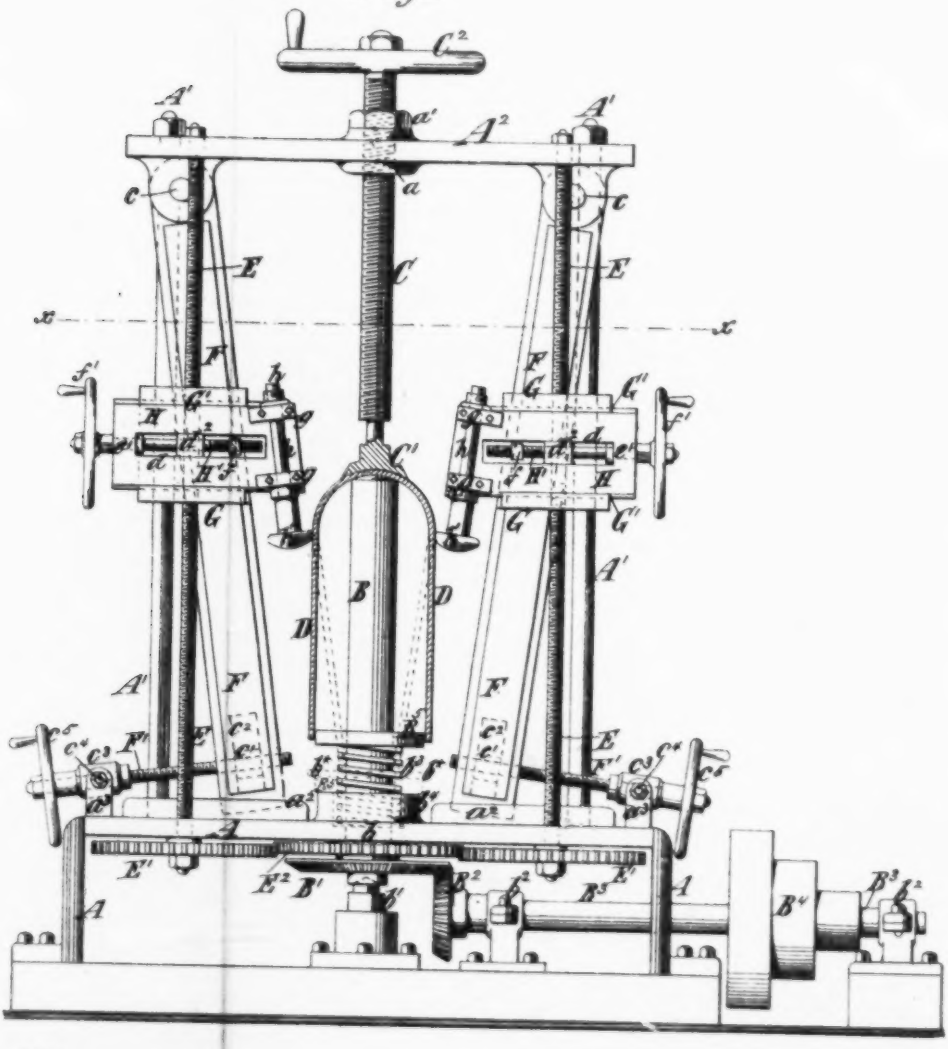
(No Model.) 2 Sheets—Sheet 1.

F. J. SEYMOUR.

MACHINE FOR SHAPING WROUGHT METAL CYLINDERS.

No. 376,167. Patented Jan. 10, 1888.

Fig 1.



Witnesses:
Matthew Polinsky
Fred Haynes

Inventor:
Fred'k J. Seymour
by his Attys.
Brown & Hall

330

(No Model.) 2 Sheets—Sheet 2.

F. J. SEYMOUR.

MACHINE FOR SHAPING WROUGHT METAL CYLINDERS.

No. 376,167. Patented Jan. 10, 1888.

Fig 2

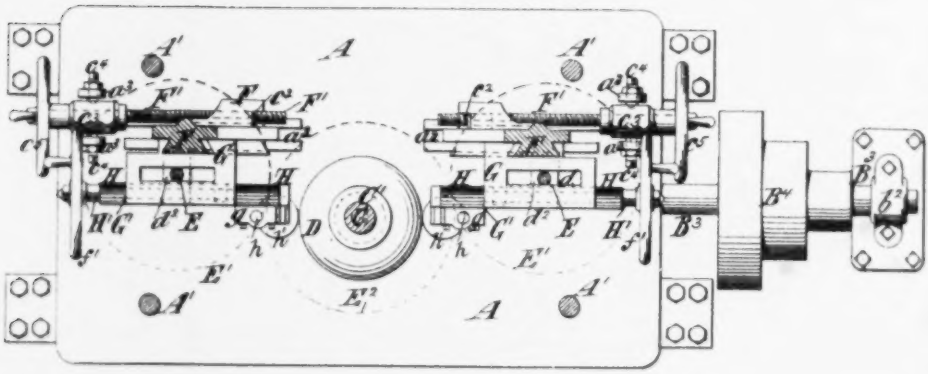
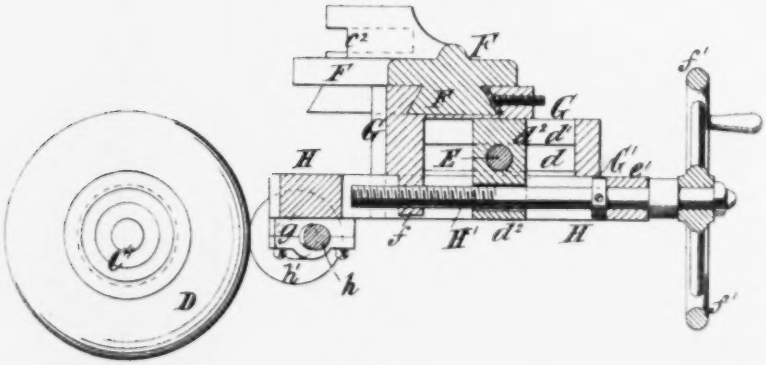


Fig 3.



Witnesses:
Matthew Pollock
Fred Haynes

Inventor
Fred'k J. Seymour
by his Attys
Brown & Hall

UNITED STATES PATENT OFFICE.

FREDERICK J. SEYMOUR, OF CLEVELAND, OHIO, ASSIGNOR TO THE BROWN'S SEAMLESS METAL COMPANY, OF JERSEY CITY, NEW JERSEY.

MACHINE FOR SHAPING WROUGHT-METAL CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 376,167, dated January 10, 1888.

Application filed June 15, 1885. Renewed June 17, 1887. Serial No. 241,610. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK J. SEYMOUR, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Machines for Shaping Wrought-Metal Cylinders or Shells, of which the following is a specification.

The object of my invention is to provide a machine whereby cylinders of steel, copper, or other wrought metal, and particularly cylinders closed and rounded at one end, may be rapidly and accurately contracted in diameter, either for the purpose of giving them a tapering form or for the purpose of contracting or shrinking them from end to end. The machine may be employed for operating upon such cylindric shells or cylinders either in a heated or cold state, and it is particularly useful for forming from such a cylinder an air-chamber having a downwardly-tapered form and necked, or having an outwardly-projecting flange at the lower open end. In this way air-chambers for pumps and other apparatus may be produced of thin steel or copper of great tensile strength and finely finished. The machine may also be employed for the purpose of contracting a number of cylindric shells one upon another, in order to make therefrom a piece of ordnance or cannon, each cylindric shell forming a mandrel upon which the next outer cylindric shell is tightly and permanently contracted.

This machine comprises a base portion or bed-plate, upon which are erected columns or posts, and a head or top plate surmounting such columns or posts. It also has a central rotary mandrel or spindle, upon which the cylinder to be operated upon is placed, and a rotary and screw-actuated steadiment, which may be brought down upon the closed end of the cylinder to hold it upon the mandrel or spindle. By the rotation of the mandrel or spindle the cylindric shell to be operated upon, whether in a heated or cold state, is turned or rotated. At opposite sides of the central mandrel or spindle are two carriages, each containing a slide having mounted upon it a rotary [illegible] or tool, and by means of ver[illegible] these carriages and their slides [illegible] moved upward and downward or traversed along the cylinder. The two carriages are mounted upon slideways or guides, which may be pivoted at one end, as at the top, and adjustable by means of adjusting-screws toward and from the central mandrel or spindle at their lower ends. As the carriages and their slides and tools are traversed up or down by the feed-screws, they will follow the direction of these slideways or guide-bars, and if the slideways or guide-bars are set with an inward inclination toward the central mandrel or spindle the carriages and their slides and tools as they traverse downward will be gradually moved inward toward the mandrel or spindle, and will thereby impart to the cylindric shell operated upon a downward-tapering form, such as would be required for the air-chamber of a pump. By means of the adjusting screws, which are at the lower end of the guide-bars, they may be set inward or outward relatively to the central mandrel or spindle, so that the spinning tools or wheels will be moved downward in lines parallel with the mandrel or spindle for producing straight work, or in lines more or less inclined relatively to the central axis for producing a downward taper or downwardly-flaring work.

In the accompanying drawings, Figure 1 is a front elevation of a machine embodying my invention. Fig. 2 is a horizontal section thereof upon the plane of the dotted line x x, Fig. 1, and Fig. 3 is a sectional view, upon a larger scale, through one of the guide-bars, its carriage, and slide, and showing also in plan a cylindric shell which is to be operated on.

Similar letters of reference designate corresponding parts in the several figures.

A designates a base-plate or bed, which may be of cast metal, and B designates a central mandrel or spindle, which projects upward through and is fitted to a suitable bearing, b, in the bed A. This mandrel or spindle also has a step-bearing, b', of any suitable construction, and has upon its lower end a bevel-wheel, B', with which engages a bevel-wheel, B^2, upon a driving-shaft, B^3. This driving-shaft is mounted in bearings b^2, and has upon it a cone-pulley, B^4, adapted to receive a driving-belt for operating the machine. Upon the mandrel or spindle B is fitted a follower or ring, B^5,

below which is a spiral spring, b^3, whereby the follower or ring B^3 is supported. This spring b^3 is capable of yielding downward, so as to be received within a chamber or cavity formed in the hub b^4 upon the top of the base A, and the follower or ring B^3 will or may come down to a bearing upon the top of this hub or projection, as is represented by dotted lines in Fig. 1.

Erected upon the base-plate or bed A are upright posts or columns A′, which are rigidly connected at their upper ends with a head or top plate, A^2, the base A, columns A′, and head A^2 forming the rigid frame work of the machine.

The top plate or head, A^2, has formed in it, in vertical alignment with the mandrel or spindle B, a nut, *a*, and to this nut is fitted an upright screw, C, which is concentric with the mandrel or spindle, and which has fitted in its lower end a rotary steadiment or foot, C′, which comes just above the top of the mandrel.

D designates the cylindric shell which is to be operated upon, and which, as here shown, is closed by a hemispherical head or end portion. This shell is placed upon the mandrel, and the follower or ring B^3 should be of such size as to enter and receive upon it the lower open end of the cylindric shell. The shell rests upon the top of the mandrel or spindle B, and by bringing the foot or steadiment C′ down against the outside thereof by turning the screw, the cylindric shell will be held in place and will be clamped to the end of the spindle or mandrel, so that it will rotate therewith. In order to prevent the accidental unscrewing of the tightening screw C, I provide it with a lock-nut, *a*′, and it may be turned by means of the hand-wheel or handle C^2.

E E designate two upright feed-screws, which are supported in suitable bearings in the bed A and top plate or head, A^2, and which have spur-wheels E′ upon their lower ends. The wheels E′ engage with and are driven by a wheel, E², fast upon the mandrel or spindle B, and through them the feed-screws E receive rotary motion.

Extending from top to bottom of the machine are guide-bars F, which, as here represented, are pivotally connected at *c* to the head or top plate, A^2, and have their lower ends adjustable toward and from the mandrel or spindle B, so that they may be set into positions inclined more or less relatively thereto.

As here represented, the bed or base A has upon it pairs of upwardly-projecting flanges, which form between them slideways a^2, in which the lower ends of the guide-bars F are held, and by which lateral motion of the guide-bars in a direction transverse to their line of adjustment is prevented.

F′ designates adjusting-screws, which engage with nuts *c*′, fitting to slideways c^2 in the lower ends of the guide-bars F. These adjusting-screws are fitted to bearings c^3, which are pivoted or supported by trunnions c^4 in lugs or ears a^3 upon the bed A, and the screws may be turned by hand-wheel c^5. The bearings c^3 and the sliding nuts *c*′ accommodate themselves to the varying positions of the guide-bars F, and by turning these screws F′ in one direction or the other the guide-bars F may be swung upon their pivots *c* and brought into positions parallel with the mandrel or spindle B, or at any desired inclination thereto, either toward or from the mandrel.

As best represented in Figs. 2 and 3, each guide-bar F has a dovetailed rib or slideway upon its face, and to this slideway is fitted a carriage, G, which has dovetailed gibs fitting the slideway, and is capable of adjustment upward and downward thereon. Each carriage is formed with a vertical slot, *d*, which receives through it the feed screw E, and it also has a horizontal slot, *d*′, in which is fitted a sliding nut, d^2, which is fitted upon the feed-screw E. As the feed-screw is rotated, the nut, being prevented from turning, will be moved up or down, and will thereby impart a vertical traverse motion to the carriage G; but the slots *d d*′ will permit of the carriage G moving freely in a lateral direction to accommodate itself to the inclination of the guide-bar F.

In the face of each carriage is a dovetailed slideway, G′, wherein is fitted a horizontally-moving slide, H, as best shown in Fig. 1. This slide H may be adjusted laterally relative to the carriage G by means of a screw, H′, which is held against lengthwise movement in a bearing, *e*′, and engages with a nut, *f*, projecting forward from the carriage G, as will be seen in Fig. 3. The screw H′ may be turned by a hand-wheel or handle, *f*′, and by so turning the screw the slide H will be moved laterally in the carriage G, inward or outward relatively to the mandrel or spindle B. The screw H′ connects the carriage and slide G H, so that as the carriage is moved upward or downward the slide will be moved with it, and will be held against accidental lateral movement. Upon the slide H are bearings *g*, in which is mounted a rotary spindle, *h*, carrying at its lower end a disk or spinning-tool, *h*′. As here represented, the spindles *h* are inclined inward and downward relatively to the mandrel B, so that as they move upward or downward their tools *h*′ will bear upon the cylinder D, while permitting the bearings *g* and slide H to clear the cylinder D.

The spindles *h* and the spinning-tools *h*′ are free to rotate by their frictional contact with the positively-driven cylinder, and as they are traversed upward and downward they contract the cylinder D, and also have a tendency to correspondingly elongate it. If the guide-bars F are set to inclined positions, as shown in Fig. 1, the carriages G and tools *h*′ will move gradually inward toward he mandrel B as the carriages are moved downward, and will thereby contract the cylinder, so that its walls when finished will be parallel with the position of the guide-bars F.

The machine as shown is adjusted for drawin

downward and necking the cylinder, so as to form an air-chamber having a flange, *b**, at its lower end, as shown by dotted lines, Fig. 1. After the tools *h'* have been moved downward and have completed their work, the screws H' may be slightly slackened, so as to move the tools *h'* from the work, and then by rotating the driving-shaft B^3 and the feed-screws E in a reverse direction to their former rotation the carriages G and the tools *h'* will be traversed upward, or returned to a position for a new operation. The mechanism for reversing the direction of the driving shaft B^3 and the feed-screws E may be of any suitable character ordinarily used in analogous machines. A convenient arrangement of mechanism will be to employ a simple counter-shaft, such as is used for driving a lathe, and which is driven by open and crossed belts capable of being shipped, or by a clutch arranged so that they may be employed in driving the counter shaft in one or other direction, as may be desired. A single belt driving from the cone on the counter-shaft onto the cone B^4 of the driving-shaft will complete the driving-gear. I have not shown the counter-shaft with its pulleys, as they are similar to the counter-shafts and pulleys ordinarily employed in driving lathes.

The cylinder or cylindric shell D may be brought to the form shown by full lines in Fig. 1, preparatory to operating upon it by this machine, by drawing with suitable dies and mandrels, and either in a heated or cold state, or in both a heated and cold state, the first drawing or folding operations being performed while the metal is heated, and the subsequent drawing operations being performed while the metal is in a cold state. The cylindric shell D may be operated upon by my improved machine either in a hot or cold state.

Not only may the machine be employed successfully in giving a downwardly-tapering form to the work D, so as to form air-chambers or other analogous or tapering articles, whether they have flanges at their lower ends or not, but it may be also employed in contracting more or less the diameter of cylindric sections, leaving them straight and of uniform diameter from end to end. The machine may in this way be employed to bind together a number of cylindric shells of different diameters, so as to form a composite gun or piece of ordnance. The shells may be made of such relative diameters by drawing that they will slip one within another, and they may by this machine be contracted one upon another, and by a number of successive operations, each cylinder forming a mandrel on which the cylinder outside it is contracted and permanently secured.

Such a method of forming a gun or piece of ordnance by contracting cylindric sections or shells one upon another is not included in this invention, but forms the subject of a separate application for Letters Patent, Serial No. 168,701, filed June 15, 1885.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with an upright rotary mandrel or spindle adapted to receive and carry a cylindric shell or tube, of guide-bars extending upward and downward at opposite sides thereof, carriages fitting the guide-bars and provided with spinning tools or disks for operating on the shell or tube, feed-screws and nuts for traversing the carriages upward and downward along the guide-bars in a direction lengthwise of the mandrel or spindle, and gearing connecting the feed-screws, whereby they are caused to rotate in unison, substantially as herein described.

2. The combination, with the central rotary mandrel or spindle, B, and a sliding follower or ring, B^5, fitted thereto and adapted to support a cylindric shell or tube, of guiding-bars, feed-screws, and carriages arranged at opposite sides of the mandrel or spindle, and spinning tools or disks on the carriages for operating upon the cylindric shell or tube, substantially as herein described.

3. The combination, with a base-frame and top frame or head and posts connecting them, of a rotary upright mandrel or spindle journaled in the base-frame, the oppositely-arranged holding screw C, fitting a nut in the top frame or head and provided at the lower end with a rotary foot or steadiment, C', guide-bars F, extending between the base-frame and top frame or head, on opposite sides of the mandrel or spindle, carriages fitted to reciprocate upward and downward along the guide-bars and provided with spinning tools or disks, and feed-screws and nuts for reciprocating the carriages and their tools along the guide-bars, substantially as herein described.

4. The combination, with the central rotary mandrel or spindle, B, the follower or ring B^5, fitted to slide upon the mandrel or spindle, and the spring b^5, for supporting the follower or ring, of guiding-bars or slideways and carriages fitted to slide thereon, spinning tools or disks upon said carriages, and feed-screws and nuts, whereby said carriages, with their tools, will be traversed along lengthwise of the mandrel or spindle, substantially as herein described.

5. The combination, with a central rotary mandrel or spindle for receiving and carrying a cylindric shell or tube, of pivoted guiding-bars or slideways and adjusting-screws, whereby said bars or slideways may be set and held stationary in positions parallel with or at any desired inclination to said mandrel or spindle, carriages fitted to said guiding-bars or slideways and carrying spinning tools or disks, feed-screws and nuts, whereby said carriages, with their tools, may be traversed along the guiding-bars or slideways in a direction lengthwise of the mandrel or spindle, and gearing connecting the feed-screws, whereby they are made to rotate in unison, substantially as herein described.

6. The combination, with the central rotary mandrel or spindle, B, of the guiding-bars F, pivoted at their upper ends, and adjusting-screws F′, engaging with nuts at the lower ends of the said bars, swiveled bearings c^3 for said screws, carriages fitted to reciprocate on said guiding-bars and carrying spinning tools or disks, and feed-screws and nuts, whereby said carriages, with their tools, may be traversed along said guiding-bars, substantially as herein described.

7. The combination, with the central upright mandrel or spindle, B, and the oppositely-arranged holding-screw and steadiment C C′, of guide-bars F, extending upward and downward on opposite sides of the mandrel or spindle and the vertical feed-screws E, the carriages G, each fitting a guide-bar and having a horizontal slideway, G′, in its face, and also having a vertical slot, d, for the reception of a feed-screw, E, and a horizontal slot, d', the nuts d^2, each fitting a feed screw and received in the slot d' of a carriage, G, the slides H, and screws H′, for adjusting them in their slideways G′, and the tools or disks carried by said slides, substantially as herein described.

FREDK. J. SEYMOUR.

Witnesses:
P. W. PAYNE,
M. P. SEARS.

adjustment is prevente
F′ designates adjusting
with nuts c', fitting to slidew
ds of the guide-bars F. Th
are fitted to bearings c^3,
supported by trunnions

Defendant's Exhibit U—State File Wrapper.
(Extracts only.)

8295

-19-

1. An open tire-shoe making machine comprising the combination of a power-driven ring-core, and a pair of stock-rolls for carrying strips of ~~rubber-coated~~ sheeted fabric having their threads at an angle for alternate application to the core, substantially as described.

2. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a transversely movable support, and a pair of stock-rolls, for carrying strips of ~~rubber-coated~~ sheeted fabric having their threads at an angle, mounted on the support for alternate juxtaposition to the ring-core, substantially as described.

3. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a rotary support, and a pair of stock-rolls, for carrying strips of ~~rubber-coated~~ sheeted fabric having their threads at an angle, mounted on the support for alternate juxtaposition to the core, substantially as described.

4. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a radially moving and laterally yielding spring-pressed support, and a spinning-roll mounted on the support for passing along the sides of the tire-shoe to shape them on the core, substantially as described.

5. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a radially moving and laterally yielding spring-pressed support, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing along the sides of the tire-shoe to shape them on the core, substantially as described.

6. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a radially moving and laterally yielding spring-pressed support, and a spinning-roll having a rounded, disc-shaped working edge mounted on the support for passing along the sides of the tire-shoe to shape them on the core, substantially as described.

7. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a radially moving and laterally yielding spring-pressed support, and a spinning-roll having a rounded disc-shaped working edge mounted on the support at a receding angle to the plane of the core for passing along the sides of the tire-shoe to shape them on the core, substantially as described.

8. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a radially moving tread-forming-roll for shaping the tire portion of the tire, a radially moving and laterally yielding spring-pressed support, and a spinning-roll mounted on the support to pass along the sides of the tire-shoe to shape them on the core, substantially as described.

9. An open tire-shoe making machine comprising the combination of a power-driven ring-core and a transversely and radially movable support carrying both a tread-forming-roll for shaping the outer portion of the tire and a laterally yielding spring-pressed spinning-roll for passing over the sides of the tire-shoe to shape them on the core, which rolls are alternately juxtaposed to the ring-core, substantially as described.

10. An open tire-shoe making machine comprising the combination of a power-driven ring-core, and a radially movable rotary support carrying a tread-forming-roll for shaping the outer portion of the tire-shoe and a laterally yielding

spinning-roll for passing along the sides of the tire-shoe to shape them on the core, substantially as described.

11. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a forming-roll, a fast-speed mechanism for actuating the ring-core during the operation of the forming-roll, and speed-changing mechanism, substantially as described.

12. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving and laterally yielding spring-pressed spinning-roll for passing over the sides of the tire-shoe to shape them on the core, fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

13. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving and laterally yielding spring-pressed support, a spinning-roll mounted on the support at a receding angle to the ring-core to pass over the sides of the tire-shoe to shape them on the core, a fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

14. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll,

a radially and transversely movable support, a tread-forming-roll and a laterally yielding spinning-roll for passing over the sides of the tire-shoe mounted thereon, fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

15. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying a spiral winding of rubber-coated fabric and muslin, and a take-up roll for taking up the muslin as the rubber-coated fabric is drawn onto the ring-core, substantially as described.

16. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying a spiral winding of rubber-coated fabric and muslin, and a yieldingly mounted take-up roll frictionally engaging the material on the stock-roll, whereby the muslin is taken up as the rubber-coated fabric is drawn onto the ring-core, substantially as described.

17. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying a strip of rubber-coated fabric, and a stretching-roll provided with divergent spirally arranged sets of grooves, whereby the longitudinal creases are taken out of the fabric in its passage to the ring-core, substantially as described.

18. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying rubber-coated fabric, a tension-roll and a stretching-roll provided with divergent, spirally arranged sets of grooves, whereby the longitudinal creases are taken out of the fabric and it is smoothly and evenly applied to the ring-core, substantially as described.

per B

19. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising the stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric having its threads at an angle and a tension-roll over which the fabric passes on its way to the core, substantially as described.

per A

20. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying rubber-coated fabric and a tension-roll covered with a layer of vulcanized rubber, substantially as described.

~~1 C 21.~~ An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying ~~rubber-coated~~ sheeted fabric, a tension-roll over and around which the fabric passes, and a stretching-roll under which the fabric runs, substantially as described.

" "

per B

~~1/ 22.~~ An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric having its threads at an angle, and a stretching-roll provided with divergent, spirally arranged sets of grooves over which the fabric passes on its way to the core, substantially as described.

" "

~~1 1 23.~~ An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head and two sets of rolls for alternate juxtaposition to the core each set comprising a stock-roll for carrying a strip of ~~rubber-coated~~ sheeted fabric having its threads at an angle, a tension-roll and a stretching-roll over which the fabric passes on its way to the core, substantially as described.

" "

8300

~~23~~ ~~25.~~ An open tire-shoe making machine comprising the combination of two power-driven ring-cores, a rotary head, a pair of stock-rolls mounted thereon for alternate juxtaposition to one core carrying ~~rubber coated~~ sheeted fabric with their threads at an angle, and another pair of stock-rolls mounted on the head for alternate juxtaposition on the other core also carrying ~~rubber coated~~ sheeted fabric with their threads at an angle, substantially as described.

per a

" "

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

(Sgd.) Will C. State

WITNESSES:

(Sgd.) R. M. Lemieux

" O. W. Myers

City of Akron, :
County of Summit, : SS:
State of Ohio :

WILL C. STATE, the above named petitioner, being duly sworn, deposes and says that he is a citizen of the United States and resident of Akron, Ohio, and that he verily believes himself to be the original, first and sole inventor of the improvement in "Pneumatic Tire-Shoe Manufacturing Machines", described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that no patent has been granted in any country foreign to the United States upon an application filed by him or his legal representatives or assigns more than twelve months prior to this application, and that no application for patent on said improvement has been filed by him or his representatives or assigns in any country foreign to the United States.

(Sgd.) Will C. State

Sworn to and subscribed before me this 22nd day of March, 190

(Sgd.) Geo. W. Rogers

(SEAL.)

Div. 15 Room 308 AS Paper No. 2

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE,

WASHINGTON, D. C., June 15, 1909.

Will C. State,

c/o Gustav Bissing,

38 Park Row,

New York City.

U.S. Patent Office
Jun 15 1909
Mailed
Division 15

Please find below a communication from the EXAMINER in charge of your application,

for PNEUMATIC TIRE-SHOE MANUFACTURING MACHINE, filed Mar. 26, 1909, #486,043.

E. B. Moore,
Commissioner of Patents.

This case has been examined.

The lugs 13 and locking member 14, top of page 5, should be identified on the drawing.

The sign 28, line 21, page 5, should be -26-.

The sign 361, line 4, page 6, cannot be found.

The fact that the stock rolls in claim 1 (and elsewhere) carry strips of certain character is immaterial to the machine structure recited therein.

Claims 1, 2 and 3 are accordingly rejected.

Claims 4, 5, 6, 7, 8, 9, 10, 19, 23, 24 and 25 are rejected upon Bayne and Subers, #847,041, Mar. 12, 1907 (154 - App. T & T.)

Claims 11, 12, 13 and 14 seem to be allowable.

Claims 15 and 16 are rejected upon

Sloper, #852,855, May 7, 1907 (154 App. T & T).

Claims 17 and 18 are rejected upon Bayne and Subers in view of an ordinary form of stretching device exemplified in

Scott, #741,381, Oct. 13, 1903 (Leather Digest).

Claims 20 and 21 are rejected upon Sloper. Whether or not the tension roll is covered with vulcanized rubber seems immaterial in view of the well known use of such rolls. It is a question of selecting a suitable material merely. (Sgd.) Chas. C. Stauffer Exr

8303

EXAMINER STANFFER.
DIVISION 15:
ROOM 308.

Serial No 486,043 Paper No 3/a

Mail Room
Aug
23
1909
U.S. Patent Office

IN THE UNITED STATES PATENT OFFICE.

THE COMMISSIONER OF PATENTS;

Sir:-

In the matter of the application of WILL C. STATE, filed March 26th, 1909, Serial No. 486,043, for "Pneumatic Tire-Shoe Manufacturing Machine", please amend as follows.

In fig. 2, to the right of the numeral 8, to the left of the numeral 38, and above the numeral 3, apply the numeral "13" to the pair of lugs and the numeral "14" to the locking member immediately therebelow.

Change the sign 28, line 21, page 5, to "26".

We shall have the numeral 361 applied to the drawing.

On page 1, line 14, after "open bellied or open tire-shoes" insert "in so far as they have been made direct from sheeted fabric".

On page 1, line 17, after "purpose" insert "of building tire-shoes from superposed layers of sheeted fabric in contradistinction to weaving the tires from threads which are woven or laid one after the other on the ring-core or former".

a'

On page 5, line 11, after "stock-roll" insert "which constitutes my sheet-fabric supply".

In claim 1, line 3; claim 2, line 3; and claim 3, line 3, before "carrying" insert "for".

In claim 4, line 2; claim 5, line 2; claim 6, line 2; claim 7, line 2; claim 8, line 2; claim 9, line 2; and claim 10, line 2, after "combination of" insert "a sheet-fabric supply,".

In claim 1, line 3; claim 2, line 4; claim 3, lines 3 and 4; claim 11, line 3; claim 12, line 3; claim 13, line 3; claim 14, lines 2 and 3; claim 19, line 5; claim 21, line 3; claim 22, line 5; claim 23, line 5; claim 25 (really24), lines 4 and 7, cancel "rubber-coated" and insert "sheeted".

Cancel claims 17 and 18 and insert the following:

17. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of fabric, a tension roll, a power-driven ring-core for drawing the fabric under tension from the stock-roll, and a stretching-roll provided with divergent, spirally arranged sets of grooves between the tension roll and the ring-core, whereby the longitudinal creases are taken out of the fabric in its passage to the ring-core, substantially as described.

a2

18. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of fabric, a tension device, a power-driven ring-core for drawing the fabric under tension from the stock-roll, and a stretching-roll between the tension device and ring-core, whereby the longitudinal creases are taken out of the fabric and it is smoothly and evenly applied to the ring-core, substantially as described.

Cancel claim 20 and renumber the remaining four claims as 20, 21, 22 and 23.

ARGUMENT.

THE REJECTION ON BAYNE et al AND SLOPER.

The State machine builds tire-shoes from superposed sheets of fabric. The machine starts with sheets. These sheets are bought in the open market. How they are woven from their threads does not concern State. The Bayne and Sloper apparatuses, as the Examiner will see at once by look-

ing at Fig. 1 of Sloper or fig. 5 of Bayne, or by reading page 1, lines 9 to 18, of Sloper or page 1, lines 23 to 35 of Bayne, build tire-shoes from separate threads or cords. They are weaving machines. They might be described as machines for knitting the threads which ultimately make up the tire on the former or ring-core.

We understand machines of the Bayne and Sloper type have actually been used in England. But, however this may be, it is of no consequence for present purposes. Whether the tire weaving machines of the references are successful or unsuccessful, good or bad, commercially existent or non-existent, they are an utterly different type of apparatus from that at bar, which might be described as a device for pasting and forming layers of sheeted fabric into tires on ring-cores.

The State apparatus is, as the specification asserts, the first of its type which has come into commercial use, and use on a large scale too; but it belongs for all that to an old type of machine, as see, for instance, the patents to Vincent No. 794473 and No. 906588, where the design is also to make open bellied tires from superposed sheets of fabric pasted together. But these Vincent machines although they have been tried have not continued in use. The dofferences which the machine of this application shows over Vincent have turned a commercial failure into success.

To still further develop the generic differences which exist between State and all machines of the weaving type like those of Bayne and Sloper, we have amended the specification on page 1, lines 14 to 18, and have put as an element into each claim a sheeted fabric supply, either generically as in claims 4 to 10 or else specifically as in the claims mentioning the stock-roller for carrying sheeted

fabric. This state of facts, now emphasized by our amendments, will, we believe, result in withdrawing the Bayne and Sloper citations and any similar thereto.

Besides, it needs but little critical comparison of the State apparatus with those of the citations to see at once that these cannot have or utilize spinning-rolls, or forming rolls, or stock-rolls for carrying a strip of rubber-coated fabric or any other of the elements of the claims excepting only the ring-core. This element is common to the two structures as it is common to a number of other structures in the present and allied arts. But State is only claiming this ring-core in combination with elements not in the references to constitute structures which perform operations of which the citations are incapable. We have then to ask for an allowance of claims 4, 5, 6, 7, 8, 9, 10, 15, 16, 19, 23, 24 and 25.

REJECTION OF CLAIMS 1, 2 and 3.

The Examiner correctly says that fact that the stock-rolls carry strips of certain character is immaterial to the machine structure recited therein. We have therefore reshaped the claims so that the strips of fabric are no longer elements of the claims and thus **m e t** the Examiner's objection. At the same time we beg to note that claim 1 raises a peculiar question and one which out ultimate antagonists in Court will insist we have solved erroneously no matter which way the decision falls. Against this claim 1, as now drawn, the defending expert will argue, as it needs no prophet to tell us, as follows: "It is, as drawn, for a mere duplication of stock rolls and since the applicant has not positively included the real inventive idea, namely the strips of fabric having their threads at an angle for alternate application to the core to make a built-up tire

hacing threads of adjacent fabric at an angle, he has not covered his real invention and his claim being, as drawn, for a mere duplication is void." Of course, had we left claim 1 in its original shape he would have argued that the fabric is not a proper element of a machine claim, citing authorities, and would have insisted that therefore claim 1 was void. Since, on the whole, it is immaterial to us which of these two positions we shall be called upon to meet, we have accepted and adopted the Examiner's requirement. All we insist upon is that, however expressed, the broad idea of combining two stock rolls for carrying fabric with threads related in a peculiar way to supply threads of proper angle to the ring-core involves invention and a fortiori its invention involved in the pair of stock rolls on a transversely movable rotary support for carrying such fabric.

THE REJECTION OF CLAIMS 17 AND 18.

The form of stretching-roll may be old. But it is used, in the State apparatus, in a new combination to effect a useful purpose. The power-driven ring-core draws the fabric, under tension, from the stock-roll. This, as State discovered and as no one before him had discovered, formed troublesome creases in the fabric between the tension device and the ring-core. Having found the difficulty he tried half a dozen remedies, without success, until he hit upon the present device of inserting a stretching-roll between the driven-core and the tension device. That solved the problem. The fact that we are dealing with what is, in a commercial sense at least, a new type of machine is a strong argument for finding invention in the application of an old element to its combinations to effect a useful purpose. The fact that State tried a number of devices before hitting

upon the successful one is another argument for patentability. Finally we beg to note that the Examiner will find that this State machine is very near the bottom of the art. He will find extremely few samples of machines showing ring-cores and stock-rolls and only a single specimen that shows as well a tension device. In this elementary state of the art, it may be safely assumed that it involves invention to put the double spiral stretching-roll between the ring-core and the tension device to get rid of the creases which have been found to form there. State has a peculiar combination and a peculiar difficulty and the addition of an element to this combination to overcome the difficulty makes a new combination even of the added element considering per se is old.

THE REJECTION OF CLAIMS 20 AND 21.

We have cancelled claim 20 which specifies the rubber-coating of the tension-roll. But claim 21 does not embrace this feature and recites a combination of elements which are certainly not found in the thread weaving machine of Bayne and Sloper.

An allowance is requested.

Respectfully submitted,

(Sgd.) Gustav Bissing

Attorney for State.

New York, Aug. 20, 1909.

Div. 15 Room 308 AS Paper No. 4

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE,

WASHINGTON, D. C., Oct. 12, 1909.

Willm C. State,

c/o Gustav Bissing,

38 Park Row,

New York City.

U. S. Patent Office
Oct 12, 1909
mailed
Division 15

Please find below a communication from the EXAMINER in charge of your application,

for PNEUMATIC TIRE-SHOE MANUFACTURING MACHINE, filed Mar. 26, 1909, #486,043.

E. B. Moore,
Commissioner of Patents.

This case considered as amended Aug. 23, 1909.

The line X is not found on Fig/ 4.

The line Y is not found on Fig. 3.

The rotary head 8 seems to be mounted upon cylinder 3 upon the drawings, instead of directly upon the base 1 as described.

Reference characters 13,14 and 361 have not been placed upon the drawings.

Reference numeral 59 should be primed, page 6, line 2 from the bottom and where it designates the lever at the right of Fig. 5.

The lead line from 62 on Fig. 1 does not terminate at a bolt.

On Fig. 3 "74" and "84" are applied to shaft 70.

Reference numeral 82 appears to be applied to a spoke of sprocket wheel 81, which wheel is not described. It is not stated how shaft 78 is driven.

On Figs. 5 the lead line should be extended from reference numeral 90 to the shaft designated.

Probably "82" on Fig. 1 should be -83-.

Reference numeral 134 is not found on the drawings.

Page 14, line 5, "157" should be -156-. Line 16, pressing

is misspelled.

Page 17, line 5 from the bottom,"121 and" should be cancelled.

Claims 1 to 3, 19, 22 and 23 are rejected upon

Vincent, #794,473, July 11, 1905 (154 - T & T) and

British patent #20,440 of 1904 (101- Feeding Web).

Claims 4 to 10 are rejected upon Bayne et al, of record, Vincent, cited, and

Vincent, #906,588, Dec. 15, 1908 (154 - T & T).

Claim 15 is rejected upon Vinvent, #794,473,

Pierce, #832,207, Oct. 2, 1906 (154 - Lin.) and

Jaeger, #410,521, Sep. 3, 1889 (101 - 36).

New claims 17 and 18 are rejected upon the Vincent patents cited and Scott of record.

(Sgd.) Chas. C. Stauffer

Examiner.

(Sgd.) L

Room 308.

8309 367

Serial No. Paper No 5

B

IN THE UNITED STATES PATENT OFFICE.

THE COMMISSIONER OF PATENTS:

Application Room Oct 29 1909 U.S. Patent Office

Sir:-

In the aplication of Will C. State, Serial Number 486,043, filed March 26, 1909, for "Pneumatic Tire-Shoe Manufacturing Machine", please amend as follows:

On page 2, line 9, after "rolls" insert,- "by radial motion with respect to the ring-core".

On page 2, line 12, before "spring-pressed" insert 'preferably".

On page 2, line 22, after "tire-shoe" insert "by radial motion with reference to the ring-core".

On page 3, lines 1 and 2, cancel "preferably".

On page 3, second line from bottom, cancel "on line X of fig. 4".

On page 4, line 1, cancel "on line Y thereof".

On page 4, three lines from bottom, after "member" insert "3".

On page 7, lines 17, 18, cancel "in such a manner that when they" and insert, "at alternate angles which means that when the stock-rolls".

On page 13, last line but one, before "support" insert,- "and in this case sliding".

On page14, line 1, after "ring-core" insert,- "that is radially with respect to the ring-core".

On page 14, line 2, change "canvas" to "sheeted fabric".

On page 14, line 5, change "157" to "156".

On page 14, line 16, change "pressind" to "pressing".

On page 14, last line but one, before "spring" insert "shown as".

On page 15, line 5, after "tool" insert "or a hand-pressed roll".

On page 15, lines 7, 8, cancel "hand-operated roll" and insert,-

"roll pressed against the core by hand".

On page 15, line 9, after "springs" insert,-

"and as an equivalent therefor".

On page 15, line 11, after "ring-core" insert,-

B'

"When then I say the spin ing-rolls or their supports are laterally spring-pressed, I mean either spring or weight pressed laterally against the ring-core for, as before stated, a spring is the equivalent of a weight. In a broader aspect of my invention, however, I may employ mechanical instrumentalities, not the hands of the operator, other than springs or weights for pressing the spinning-rolls laterally against the ring-core. I shall, then, use the term "power-pressed" to cover generally not only springs and weights but other mechanical instrumentalities for pressing the spinning-rolls against the ring-core. When I refer to my spinning-rolls as laterally yielding and no more, I means to include any source or power for pressing the spinning-rolls against the ring-core, even the comparatively inefficient and irregular power contained in the hands of the operator.

On page 18, last line, change "four or five" to "seven or eight".

Cancel the claims and insert,-

B²

1. An open tire-shoe making machine comprising the combination of a power-driven ring-core, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles for alternate application

to the core, substantially as described.

2. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a transversely movable support, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles mounted on the support for alternate juxtaposition to the ring-core, substantially as described.

3. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a rotary support, and a pair of stock-rolls for carrying strips of sheeted fabric having their threads at alternate angles, mounted on the support for alternate juxtaposition to the core, substantially as described.

4. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

5. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

6. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disc-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted

fabric on the core, substantially as described.

7. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally spring-pressed toward the core, and a spinning-roll having a rounded disc-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

8. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially movable tread-forming-roll for shaping the outer portion of the tire, a radially moving support laterally spring-pressed against the core, and a spinning-roll mounted on the support to pass radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

9. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core and a transversely and radially movable support carrying both a tread-forming-roll for shaping the outer portion of the tire and a laterally yielding spinning-roll for passing radially over the sides of the tire-shoe to shape the sheeted fabric on the core, which rolls are alternately juxtaposed to the ring-core, substantially as described.

10. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, and a radially movable, rotary support carrying a tread-forming-roll for shaping the outer portion of the tire-shoe and a laterally yielding spinning-roll for passing radially radi[illegible]ng the sides of the tire-shoe to shape the sheeted fabric roll[illegible] the core, substantially as described.
rad

11. An open tire-shoe making machine comprising

the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a forming-roll, a fast-speed mechanism for actuating the ring-core during the operation of the forming-roll, and speed-changing mechanism, substantially as described.

12. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving spinning-roll for passing radially over the side of the tire-shoe to shape the fabric on the core, fast-speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

13. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheet-fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially moving support laterally power-pressed against the ring-core, a spinning-roll mounted on the support at a receding angle to the ring-core to pass over the side of the tire-shoe to shape the fabric on the core, a fast speed mechanism for actuating the ring-core during the operation of the spinning-roll, and speed-changing mechanism, substantially as described.

14. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a ring-core, a slow-speed mechanism for actuating the core when receiving fabric from the stock-roll, a radially and transversely movable support, a tread-forming-roll and a laterally yielding spinning-roll for passing radially over the sides of the tire-shoe mounted thereon,

fast-speed mechanism for actuating the ring-core during the operation of the tread-forming and spinning-rolls, and speed-changing mechanism, substantially as described.

15. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying a spiral winding of rubber-coated fabric and muslin, or the like, and a yieldingly mounted take-up roll frictionally engaging the material on the stock-roll, whereby the muslin is taken up as the rubber-coated fabric is drawn onto the ring-core, substantially as described.

16. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a tension-roll, a power-driven ring-core for drawing the sheeted fabric under tension from the stock-roll, and a stretching-roll provided with divergent, spirally arranged sets of grooves between the tension roll and the ring-core, whereby the longitudinal creases are taken out of the fabric in its passage to the ring-core, substantially as described.

17. An open tire-shoe making machine comprising the combination of a stock-roll for carrying a strip of sheeted fabric, a tension device, a power-driven ring-core for drawing the fabric under tension from the stock-roll, and a stretching-roll between the tension device and ring-core, whereby the longitudinal creases are taken out of the fabric and it is smoothly and evenly applied to the ring-core, substantially as described.

18. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising the stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, and a tension-roll over which the fabric passes on its way to the

core, substantially as described.

Cancelled per C.

19. An open tire-shoe making machine comprising the combination of a power-driven ring-core, a stock-roll for carrying sheeted fabric, a tension-roll over and around which the fabric passes, and a stretching roll under which the fabric runs, substantially as described.

~~20.~~ An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head, and two sets of rolls for alternate juxtaposition to the core, each set comprising a stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, and a stretching-roll provided with divergent, spirally arranged sets of grooves over which the fabric passes on its way to the core, substantially as described.

~~21.~~ An open tire-shoe making machine comprising the combination of a power-driven ring-core, a movable head and two sets of rolls for alternate juxtaposition to the core, each set comprising a stock-roll for carrying a strip of sheeted fabric having its threads at alternate angles, a tension-roll and a stretching-roll over which the fabric passes on its way to the core, substantially as described.

~~22.~~ An open tire-shoe making machine comprising the combination of two power-driven ring-cores, a rotary head, a pair of stock-rolls mounted thereon for alternate juxtaposition to one core carrying sheeted fabric with their threads at alternate angles, and another pair of stock-rolls mounted on the head for alternate juxtaposition to the other core also carrying sheeted fabric with their threads at alternate angles, substantially as described.

~~23.~~ An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed

toward the core, and a spinning-roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

~~24.~~ 23 An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

~~25.~~ 24 An open tire-shoe makingmachine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the ~~xxxxx~~core, and a spinning-roll having a rounded disc-shaped working edge mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric, on the core, substantially as described.

~~26.~~ 25 An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning-roll having a rounded disc-shaped working edge mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described.

~~27.~~ 26 An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core for drawing the sheet-fabric from the source of supply in a flat condition, a radially sliding support, and a laterally yielding spinning-roll on the support for passing radially along the sides of the ring-core to curve and shape the sheet-

ed fabric thereon, substantially as described.

Respectfully submitted,

(Sgd.) Gustav Biesing

Attorney for State.

New York, October 29, 1909.

8318

UNITED STATES PATENT OFFICE

County of Summit :
:
State of Ohio :

Will C. State, a citizen of the United States, residing at the corner of College and East Market Streets, Akron, Ohio, being duly sworn, deposes as follows:

I am applicant in Application #486043, filed March 26th, 1909, for Pneumatic Tire Shoe Manufacturing Machines.

As Mechanical Engineer of The Goodyear Tire & Rubber Company, I am necessarily familiar with the art of making Tire Shoes for Pneumatic Tires, especially from multiple plies or layers superposed on each other; this being the present practice.

I believe that the Machine described in this Application is the first which has ever been commercially used for making such Tire Shoes, and that heretofore such multiple layer Pneumatic Tire Shoes have been entirely made by hand.

I am informed and believe that a Machine about as shown in the Vincent Patent #794473, and employing hammers for shaping the tire fabric on the sides of the ring core, has been used in this country, but that it proved unsatisfactory and was abandoned.

From an actual first-hand knowledge of the facts, I have found that an operator can readily make over forty tires a day on my Machine; whereas, by hand, he has heretofore been able finish about seven or eight tires , to

the extent to which they are finished on the Machine.

In the course of developing my Machine, the fabric as it was drawn from the supply rolls on to the ring core, would fall into creases. This was, in part, due to the fact that the fabric comes off the supply roll in a flat state, and is pulled from the high or peripheral part of the ring core into a curved or bowed condition. To obviate this defect, I first used a roll about as broad as the fabric and slightly bowed in the center, thinking in this way to support the material in a curved condition, and thus to remove the creases. This plan proved unsuccessful. I thereupon used a very sharp oval roll, to give a considerable curve, transversely considered, to the fabric. This again was unsuccessful. I then used the stretching rolls shown in my application, but had to try them in several positions with relation to the fabric, above and below, before the satisfactory arrangement now shown in my application was reached.

(Sgd.) Will C. State

Sworn to and subscribed before me this 22nd day of October, ninteen hundred nine.

(Sgd.) Geo. W. Rogers

Notary Public.

(SEAL.)

8320

THE UNITED STATES PATENT OFFICE.

County of Summit :
:
State of Ohio :

Frank A. Seiberling, being duly sworn, deposes as follows:

I am a resident of Akron, Ohio, and President of The Goodyear Tire & Rubber Company of that place. I am entirely familiar with the Tire Shoe Making Machine described in the State Application #486043 filed March 26th, 1909.

As President of The Goodyear Tire & Rubber Company, it has been my business to keep informed on the art of making Pneumatic Tire Shoes, and I have kept myself so informed by discussing the state of the art with the various competitors of The Goodyear Company, by visiting other factories where Tire Shoes are made, and by reading the trade journals.

I believe that before the State invention multiple layer Pneumatic Tire Shoes which are built up from successive superposed layers of fabric have been practically exclusively made by hand, and that the State Machine is the first to successfully make such Tires on a commercial scale by machinery.

A machine-made Tire, by reason of greater evenness of manufacture, is also a better Tire that those heretofore made by hand. As a consequence, the State Machine has been

introduced into the factory of The Goodyear Tire & Rubber Company, and is turning out a large number of Tires each day, which are being sold and used in the regular way.

A number of these Tire-Making Machines have also been built and are building and are being leased under royalty to the principal tire manufacturers in the country, such as the Hartford Rubber Works Company of Hartford, Ct., Morgan & Wright Company of Detroit, Mch., and the Fisk Rubber Company of Chicopee Falls, Mass.

As a result of actual test, it has been ascertained that a man with the State Machine can produce at least five times as many Tires in a day as under the old hand process.

Affiant has, furthermore, been informed from several responsible sources, and believes that a machine like that of the Vincent Patent #794473, employing a set of hammers to shape the fabric on the sides of the ring-core, has been actually tried in one of the large tire-making factories in this country, but that it was unsuccessful and that its use has been abandoned.

(Sgd.) Frank A. Seiberling

Sworn to and subscribed before me this 22nd day of October, ninteen hundred nine.

(Sgd.) Geo. W. Rogers

(SEAL.) Notary Public

6
6

Application Room
Oct
30
1909
U.S. Patent Office

IN THE UNITED STATES PATENT OFFICE.

THE COMMISSIONER OF PATENTS:

Sir:

In the application of Will C. State, Serial No. 486,043, filed March 26, 1909, for "Pneumatic Tire-Shoe Manufacturing Machine", please amend as follows:

Cancel claim 19 and renumber.

(Sgd.) Gustav Bissing

Atty.

J. H. Serial No. 486,043. 395

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE,

WASHINGTON, D. C., Nov. 5, 1909.

Will C. State, Assor.,

c/o Gustav Bissing,

38 Park Row,

New York, N.Y.

Sir: Your APPLICATION for a patent for an IMPROVEMENT in Pneumatic Tire-Shoe Manufacturing Machine, filed Mar. 26, 1909, has been examined and ALLOWED.

(Balance of Official Notice of Allowance.)

Drawing showing limit of inward motion of rolls 30.

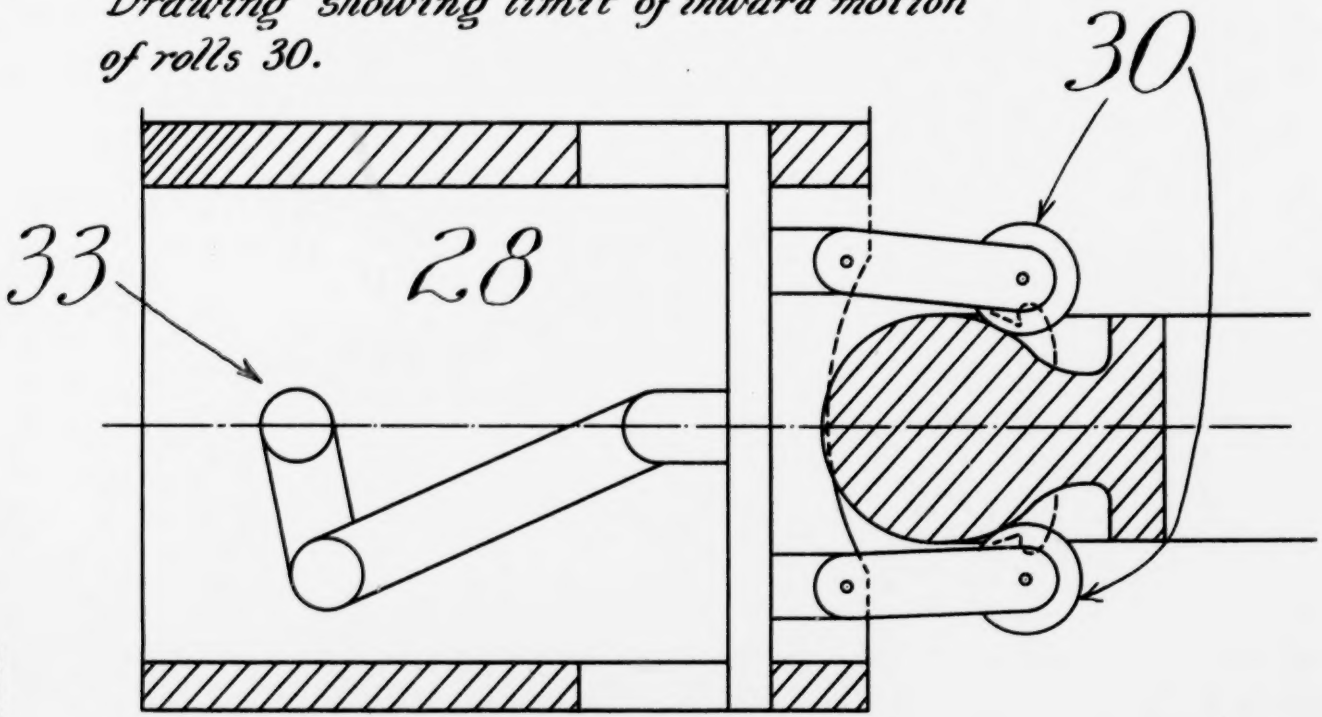


Fig. 4. (Ray.)

Defendant's Exhibit Z.

In the United States District Court for the District of New Jersey.

In Equity. No. 614.

[Title omitted.]

Ro[illegible] Campbell, Esqs., for complainant.
E. Cl[illegible]sq., and Thos. G. Haight, Esq., for defendant.

Opinion.

[Filed February 14, 1922.]

BODINE, *District Judge:* This case involves letters patent 941,962 for a tire making machine, granted November 30, 1907, upon the application of Will G. State, his interest assigned to the plaintiff. The bill also claims an infringement of patent 762,561 granted on the application of Messrs. Seiberling and Stevens. This patent has been withdrawn and a decree is asked under the State patent alone.

The plaintiff's patent was before the Circuit Court of Appeals for the Sixth Circuit in the case of Firestone Tire and Rubber Company v. Seiberling, 257 Fed. Reporter 74. The claim is urged, however, that the record in the present case is so distinct from the record in that case that a different result is inevitable, the distinction being that a disclaimer having been filed February 14, 1919, claims 1, 2, 3, 18, 19, 20 and 21 are not in suit and claims 8, 9, 10, 11, 14, 15, 16 and 17 have been erased. The effect of the disclaimer is broadly to limit the patent to a combination in a tire making machine of a forming or spinning roll with a high speed core. The method or process used is the same which the proofs showed had for many years prior to the patent been used in the making of tires by hand.

The Circuit Court of Appeals for the Sixth Circuit considered the case as though before them in its present aspect. See page 82. If further authority is necessary see Conroy v. Penn Electrical & Manufacturing Company, 115 Fed. 421, affirmed 159 Fed. 943. The result reached makes it unnecessary to pursue the many other grounds urged for the invalidity of the patent.

The relief sought will be denied.

In the United States District Court for the District of New Jersey.

In Equity. No. 614.

[Title omitted.]

Final Decree.

[Filed February 21, 1922.]

This cause came on to be heard at the September, 1921, term, and was argued by counsel on December 13 and 14, 1921, and thereupon, upon consideration thereof, it is

Ordered, adjudged and decreed that the bill of complaint herein be, and the same hereby is, dismissed, with costs to the defendant to be taxed. J. L. Bodine, United States District Judge. February 21, 1922.

Form approved. Rogers, Kennedy & Campbell, Solicitors for Plaintiff.

In the District Court of the United States for the District of New Jersey.

In Equity. No. 614.

[Title omitted.]

Assignment of Errors.

[Filed March 2, 1922.]

In pursuance of and obedient to the rules and practice of the United States Circuit Court of Appeals for the Third Circuit, in such cases made and provided, the above-named plaintiff respectfully makes the following assignment of errors in the above entitled cause, to wit:

1. The Court erred in dismissing and not in sustaining the bill of complaint herein.

2. The Court erred in failing to award a decree for plaintiff in accordance with the bill of complaint.

3. The Court erred in failing to hold that claims 4, 5, 6, 7, 12, 13, 22, 23, 24, 25 and 26 of the State Patent No. 941,962 in suit, are valid and infringed by defendant's machine.

4. The Court erred in basing its decision on that of the Circuit Court of Appeals for the Sixth Circuit, and in failing to find that the present record is materially different from that before the said Circuit Court of Appeals, and in not rendering an independent decision upon the different state of facts herein.

5. The Court erred in refusing to grant the relief sought in the bill of complaint.

6. The Court erred in not awarding an injunction against defendant.

7. The Court erred in not decreeing an accounting of profits and damages for defendant's infringement.

Wherefore the said plaintiff, Frank A. Seiberling, prays that the decree of the said District Court of the United States for the District of New Jersey be reversed, and that the said District Court of the United States for the District of New Jersey be directed to enter a decree for said plaintiff in conformity with the prayer of his bill of complaint. Frank A. Seiberling, By Rogers, Kennedy & Campbell, Solicitors and of Counsel for Plaintiff.

In the District Court of the United States for the District of New Jersey.

In Equity. No. 614.

[Title omitted.]

Petition for Appeal.

[Filed March 2, 1922.]

The above-named plaintiff, conceiving itself aggrieved by the decree made and entered in the above-entitled cause and filed in the office of the clerk of this court, in the City of Trenton, in the District of New Jersey, on the twenty-first day of February, 1922, hereby appeals therefrom to the United States Circuit Court of Appeals for the Third Circuit, for the reasons specified in the assignment of errors, and prays that its appeal may be allowed, and that a citation may be directed to the above named defendant, The John E. Thropp's Sons Company, commanding it to appear before the United States Circuit Court of Appeals for the Third Circuit, to do and receive what may appertain to justice to be done in the premises; and that a transcript of the record, proceedings, evidence and opinion in said cause, duly authenticated, may be sent to the United States Circuit Court of Appeals for the Third Circuit; and that the said decree of the United States District Court for the District of New Jersey herein may be reversed, and such decree made as to the said United States Circuit Court of Appeals for the Third Circuit, may seem meet and just.

And your petitioner further prays that the proper order touching the security to be required of him to permit his appeal be made. Frank A. Seiberling, By Rogers, Kennedy & Campbell, Solicitors and of Counsel for Plaintiff.

Order Allowing Appeal and Fixing Bond.

[Filed March 2, 1922.]

And now, to wit, this second day of March, 1922, upon consideration of the foregoing petition, it is ordered by the Court that the appeal prayed for therein be, and the same is hereby allowed, and the amount of the appeal bond to be entered by the petitioner is hereby fixed at the sum of two hundred and fifty dollars ($250). J. L. Bodine, U. S. Judge.

Citation and Service.

[Filed April 14, 1922.]

By the Honorable Joseph L. Bodine, Judge of the District Court of the United States for the District of New Jersey, to the John E. Thropp's Sons Company:

Whereas, Frank A. Seiberling, has lately appealed to the United States Circuit Court of Appeals for the Third Circuit, from final decree lately rendered in the District Court of the United States, for the District of New Jersey, made in favor of you, the said The John E. Thropp's Sons Company, and has filed the security required by law; you are, therefore, hereby cited to appear before the said United States Circuit Court of Appeals, for the Third Circuit, to be held at the city of Philadelphia, in the State of Pennsylvania, on the twenty-ninth day of April next, to do and receive what may appertain to justice to be done in the premises.

Given under my hand, at the City of Trenton, in the District of New Jersey, in the Third Circuit, the thirtieth day of March, in the year of our Lord one thousand nine hundred and twenty-two. J. L. Bodine, Judge.

Service of a copy of the within citation acknowledged this first day of April, 1922. E. H. W. Seward, Solicitor for Defendant.

In the United States Circuit Court of Appeals for the Third Circuit, March Term, 1922.

No. 2862 (List No. 55).

[Title omitted.]

Argument and Submission.

And afterwards, to wit, on the 9th & 10th days of May, 1922, come the parties aforesaid by their counsel aforesaid, and this case being called for argument sur pleadings and briefs, before the Hon-

orable Joseph Buffington, Honorable Victor B. Woolley and Honorable J. Warren Davis, Circuit Judges, and the Court not being fully advised in the premises, takes further time for the consideration thereof,

And afterwards, to wit, on the 19th day of October, 1922, come the parties aforesaid by their counsel aforesaid, and the Court, now being fully advised in the premises, renders the following decision:

In the United States Circuit Court of Appeals, Third Circuit, October Term, 1922.

No. 2862.

[Title omitted.]

Opinion.

[Filed Oct. 19, 1922.]

Appeal from the District Court of the United States for the District of New Jersey.

Before Buffington, Woolley, and Davis, Circuit Judges.

BUFFINGTON, *C. J.*: In the Court below, suit was brought by the owner of Patent No. 941,962, granted November 30, 1909, to Will C. State, for a pneumatic tire-shoe manufacturing machine. The suit charged infringement by the John E. Thropp Company of Claims 4, 5, 6, 7, 12, 13 and 22 to 26 inclusive.

As shown in its opinion printed in the margin* the Court below conceived the case was substantially the same as that decided by the Circuit Court of Appeals of the Sixth Circuit, reported at 257 Fed.

*"This case involves letters patent 941,962 for a tire making machine, granted November 30, 1909, upon the application of Will C. State, his interest assigned to the plaintiff. The bill also claims an infringement of patent 762,561 granted on the application of Messrs. Seiberling and Stevens. This patent has been withdrawn and a decree is asked under the State patent alone.

The plaintiff's patent was before the Circuit Court of Appeals for the Sixth Circuit in the case of Firestone Tire and Rubber Company v. Seiberling, 257 Fed. Rep. 74. The claim is urged, however, that the record in the present case is so distinct from the record in that case that a different result is inevitable, the distinction being that a disclaimer having been filed February 14, 1919, claims 1, 2, 3, 18, 19, 20 and 21 are not in suit and claims 8, 9, 10, 11, 14, 15, 16 and 17 have been erased. The effect of the disclaimer is broadly to limit the patent to a combination in a tire making machine of a forming or spinning roll with a high speed core. The method or process used is the same which the proofs showed had for many years prior to the patent been used in the making of tires by hand.

The Circuit Court of Appeals for the Sixth Circuit considered the case as though before them in its present aspect. See page 82. If further authority is necessary see Conroy v. Penn Electrical & Manufacturing Company, 115 Fed. 421, affirmed 159 Fed. 943. The result reached makes it unnecessary to pursue the many other grounds urged for the invalidity of the patent. The relief sought will be denied."

Rep., and without itself entering into a discussion of the issues here involved, it in effect followed that case. As in our view the record presented in this case is substantially different from that before the Circuit Court of Appeals in the case cited, we are justified in placing of record a full statement of the issues here involved and our reasons for reversing the decree entered below.

The case is important. It concerns the machine-making of a pneumatic rubber shoe for an automobile tire, and a satisfactory tire is the measure of an automobile's efficiency. Such shoe is a built-up product, composed of successive layers of fabric cemented or plastered to each other. Leaving aside the tires made by a single stretch of fibrous material, and which were forced into place on the side of the shoe by what are known as "jigger fingers," and confining ourselves to shoes in which the material is stretched at different parts of the shoe in two directions at right angles to each other, and to a process of cementing or plastering them in place by a spinning roll, we note the fact that tires embodying these two features of double stretch and roll-spinning fastening, were, before the patent to State here in question, hand made.

A statement of the old, hand-made art is so clearly set forth by Judge Denison in the opinion in the Sixth Circuit case, we copy his words: "An annular metallic core having spokes and a hub was centrally mounted upon a shaft so that it could revolve, the core thus resembling the rim or tire of a wheel. This core was approximately circular in cross-section, and its cross-section diameter as well as its entire diameter through the hub from edge to edge of the rim were proportioned according to the size of the casing to be made. The operator coated this core with an adhesive substance. He then took a strip of rubber-impregnated fabric which would stretch out to be as long as the circumference of the core, and in width somewhat less than the circumference of the cross-section. As he revolved the core on its hub, he stretched and pasted this fabric strip upon the core, pressing and shaping it with his fingers or with hand tools so that it adhered in all places and was without wrinkles. He repeated this operation as many times as there were to be fabric layers in the casing. The impregnating composition, having the character of rubber, would also attach each two layers of the fabric together. The strip of fabric was cut upon the bias, and the warp threads therefore ran from the inner open edge of the tube in a diagonal course along, across and around the tube to the other open edge thereof; and the next layer of fabric put on was reversed so that these warp threads crossed those of the first layer at a selected angle. Where the ends of the fabric met each other, they were overlapped enough to make a pasted joint. Each layer of fabric was first pressed down and attached by the hand of the operator on its central portion throughout its length, thus constituting the part of the casing corresponding to the tread. The degree of lateral curvature here is slight, and there would be no difficulty in making a smooth attachment, but as it was continued around the remaining circumference of the cross-section, there would be an obvious tendency to gather and

wrinkle. This wrinkling would be fatal to the strength of the casing, and it could be avoided only by careful manipulation and gradual shaping. The ultimately smooth and unwrinkled surface could be had by virtue of a quality which all woven material has had since weaving was known; *i. e.* that it will contract in one direction, as it stretches in another, when a fabric is stretched in one diagonal direction, its square meshes become diamond-shaped, with the length of the diamond along the line of stretch and its width at right angles. This produces a contraction of the fabric in the line of its width. In tire building, it is primarily the central part of the strip which is thus stretched longitudinally as it is attached to the tread of the core, leaving the side portions or wings projecting and free. Upon the same principle, if these side portions are then stretched laterally, they will shrink longitudinally, and, if this stretching is done in progressive measure as the edges are approached, the longitudinal shrinking will be greatest at the edge. In this way, it results that the fabric may be shaped smoothly and without wrinkles to the entire side core surface." With this picture distinctly in mind, it will be seen that in making such a shoe we have to deal with a series of non-uniform circumferences, viz: the longest circumference length at the outer or tread periphery of the core; at the two sides of the core the circumference length will be smaller, and as the inner or bead edge of the core is reached we have a still smaller circumference length. It is therefore apparent that as there is a lessening of core circumference from the outer or tread circumference zone to the shorter zone of the side and the still shorter one at the bead edge, and as the unitary rectangular fibrous sheet to cover these zones is of uniform length, puckers or wrinkles in such fibrous material would necessarily be formed in these shorter circumferences unless in some way the rectangular fabric of uniform length was shortened as it was cemented on these lesser core circumference zones. When the tread or outer periphery covering sheet was circumferentially stretched from normal, of course, as explained by Judge Denison, its square meshes became diamond-shaped, with the diamond in the line of circumference stretch. If this stretch was gradually diminished until the side zone of the core was reached, the diamond of the covering would correspondingly recede into the square of the normal form, and we would then have the normal unpuckered length of the fibrous material automatically taken care of at that point, and if, as the inner or bead edge of the shoe was reached, the fibrous material was stretched at right angles to the core, then its squares would take the form of radially pointed diamonds, and that would necessarily contract the length of the rectangular material. In other words, there was an initial stretch of the fabric from its normal squares into circumferential diamond-shape interstices. That made the tread portion of the tire. There was a normal square of the material at the side of the shoe, and below that there was a radial stretch of the covering at the inner or bead edge of the shoe, which changed the square to a radial diamond shaped interstice and correspondingly lessened the normal length of

the fabric. As explained by Judge Denison, this was accomplished in the hand process by the operator, who "stretched and pasted this fabric strip upon the core, pressing and shaping it with his fingers or with hand tools so that it adhered in all places and was without wrinkles". But the avoidance or elimination of wrinkles became more difficult as the zone of smaller circumference length was reached, and in that respect he said, "Each layer of fabric was first pressed down and attached by the hand of the operator on the central portion throughout its length, thus constituting the part of the casing corresponding to the tread. The degree of lateral curvature here is slight and there would be no difficulty in making a smooth attachment, but as it was continued around the remaining circumference of the cross-section, there would be an obvious tendency to gather and wrinkle. This wrinkling would be fatal to the strength of the casing, and it could be avoided only by careful manipulation and gradual shaping." This hand work required high skill and was physically hard on the operator. The core had to be actuated by one hand and the spinning roll directed by the other. Where the different layers of fabric overlapped, the roll was apt to jump. The initial speed of the core could not be maintained unless one hand of the tire maker was employed in revolving it and if one hand was so employed its non-use on the spinning roll of course made the roll jumping trouble more acute. Moreover, the variation in speed caused corresponding variation in the regularity and uniformity of the interstices of the fibrous material, and the output was limited to the strength and skill of the operator. The evidence is that under the hand tool process the possible production was but a few tires per day, but as its double stretch was regarded as most effective in securing tire strength, it was nevertheless continued. Hence the effort to devise a way to manufacture tires by machine. This was first attempted in a machine of wholly different type from the one here in question. That machine was the invention of Seiberling and Stevens and was the leading subject-matter in the case in the Sixth Circuit. Seiberling and Stevens' plan was to use jigger fingers, but the proof is that their jigger finger machine was not commercially successful and was commercially scrapped. In this state of the art, in 1907 State undertook to adapt the other or hand roll method of making a double stretched tire to machinery. Certain elements entering into that problem were of course well known. The fact of the desirability of the initial circumferential stretch of the tread portion into circumferential diamonds, was in use; the lessening of stretch resulting in squares on the side of the shoe was a well known practice, as was also the radial stretch for the inner portion of the shoe, which turned the square of the fabric into a diamond shape at right angles with the diamonds of the initial or tread stretch. So also the use of a hand or spinning roll was well known, and the problem involved, as in most machine improvements, was to take these well understood and recognized processes which were done by hand and directed by skill, and do the same work by machinery. This problem State met, and for the first time successfully solved in a machine-made tire of the double stretch character indicated. The machine he produced

was at once recognized. It went into instant use. On such machines millions of tires have been built, and large numbers of companies have taken out licenses under the patent.

In determining the inventive character of State's work, the first question involved is whether the successful machine first disclosed by him was a mere mechanical aggregation of separate well known steps, or a co-operating combination. We note, first, that what we are here dealing with is a unitary product, namely, a completed, machine-made shoe tire for an automobile. We are not dealing with the making of the tread portion of a tire alone, and with its consequent necessary circumferential stretch and the formation of circumferential diamond shaped interstices in the fabric in such tread portion. We are not dealing with the making of the median zone of the shoe, with the interstices square and unstretched. Nor are we dealing with the making of a bead zone where the stretch is radial and the interstices are radially pointed diamond shaped. But we are concerned with the machine-making of a finished tire in which there is a continuity of sustained, inter-related and necessary co-operation, in which there is a progressive length non-uniformity and an angle change of stretch, in which there is a change of speed rotation at different stages, and in which every one of the separate operations of the machine is individually essential to the completion of the unitary product of the unitary machine. Analyzing such machine, we note that in the tread circumference there is a low speed, and we there start with a circumferential stretch and a circumferential diamond-shaped interstice. Its separate processes and their product do not end and are not completed at any given point, but as each distinct process and mode of operation begins and carries on it correspondingly modifies the product, and as the machine functions in its entirety, there is a gradual and progressive change in the continuous operation and in the progressing and changing product, which gradually, uniformly, evenly and continuously changes the product of the machine from the initial circumferential stretch and the circumferential headed diamond-shaped interstices into a gradual approach to the normal square with its substantially unstretched fabric into which the product gradually shapes itself up to the side or median line. But the process does not stop here, for there is still a continual shading, this time from the square of the median zone of the tire side into the radial circumferential stretch of the bead or inner portion of the tire, and a gradual departure from the unstretched square of the median line to the radially stretched and radially pointed diamond shaped interstices of the bead or inner portion. Far from being separated, isolated zone processes, there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the consequent exercise of centrifugal force on the covering material, by which it is automatically gradually stretched radially and by the joint action of such centrifugal, radial stretch, and the spinning rolls, the square of the median zone progressively shades into the radial diamond shaped interstices of the bead or inner zone of the shoe. In a way we

have anticipated what State's machine really is, by thus describing its results. But such statement should be initially made, for the crux and dominating functional feature of State's machine is the use upon the fabric of a centrifugal force caused by rapid rotation, a process which is wholly different from the original hand process, and one which State in the experiments which he carried along in the development of his machine, first found he could utilize. Briefly stated, his machine may be thus described: He took the old core wheel of the hand process, and used impregnated strips of fabric and formed the outer or tread portion of the shoe and cemented it to the core, just as had been done in the old hand process. He continued that process just as it had been in the hand process, down to the point where he plastered or cemented the fabric on to the core down to the median line point. But here he changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric. At this point we note that State made use of a shifting platform, on which he mounted on each side of the tire spinning wheels or rolls so pressed inwardly by springs that as the rolls revolved they engaged and pushed inward and against the sides of the core the stretched flying skirts of the fabric. Thereby he then, and by the wheels, pressed and cemented the radially stretched and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge. It will therefore be seen that the essence of his disclosure was the rapid, sustained, regular revolution of his core, the use of a shifting platform on which he located his spinning rolls, and the constant, regular and uniform exertion of pressure upon those spinning rolls, causing them to automatically press the automatically stretched and loose fabric, or skirts, in an unwrinkled state, on the bead of the lower surface of the core. If this statement of the process be correct, and there can be no doubt in that regard, it follows that the process is a unitary one, is a continuous one, is an inter-related one, is an undivided one, and that there is a continuity of uniform, sustained, progressive, advance from the start to the finish of this machine-made tire, which is brought about by the rapid revolution of the core wheel acted upon by the spin of spring-controlled engaging rolls co-operating with the centrifugal force generated by the rapid motion of the core. In other words, united, co-operating, conjoint functioning of the core speed and spinning rolls, effected by roll springs and the shift of roll platform, all conjointly functioning to produce a unitary machine result which neither of them separately could effect. Such being the mechanical fact, who shall combat the patent deduction that these elements brought together and assembled for the first time by State, stamp the combination as an inventive combination and not as a mere mechanical aggregation of disjointed steps. At no single stage of this machine's processes do we find a complete, separate, finished entity. Standing alone, the tread with its circumferential diamond shaped interstices is nothing; the median or square por-

tion with its normal square, is nothing; the bead with its radial stretch and diamond pointed interstices is nothing. It is when each co-operating element in combination with its fellows has done its individual but still co-operating work, we produce the unitary and finished product which State for the first time made by machinery and which made such a great change in the tire art. Each element acts and has to co-act with its fellows to product the unitary result and make the unitary product which alone the machine was fashioned and devised to produce. And not only is this conclusion the inevitable sequence of a clear understanding of the process, but the question of aggregation and combination is strikingly solved, and practically answered by a study of the evolutionary processes or stages by which through some fifteen different steps the patentee gradually evolved in the tire-building art, the successful co-relation and adaptation of well-known hand operations to machine operations. The problem was one of great difficulty. It was not solved even by a single inventive thought or by its initial conception, but with the settled purpose in view of substituting machinery for hand work and automatic machine control for human skill. State went through a most unusual series of experiments, and as each one was made it disclosed some difficulty which he had to overcome and did overcome step by step until at last he evolved a structure which did by rapid machine work, and largely by automatic operation, what was previously solely and laboriously done by exhaustive hand work. That the result was novel, is established by proof. That it was useful is shown by its prompt and general adoption as well as by the vast aggregate of its product, and that it was inventive is demonstrated not only by its own facts but it is evidenced by the cases decided by many different judges in this industrial circuit, who have from time to time carefully followed a clear controlling principle in dealing with the question of aggregation or combination in machines. That general principle is that the earmark of combination is the co-acting of the elements to produce a unitary result. In the early case of The Societe v. Rehfuss, 75 Fed. Rep. 657, Judge Acheson, in considering a machine where during the continuous process operation of a pearl button cutting lathe, a sharpening wheel was brought into relation to the cutting tool, said:

"The several constituents co-operate in respect to the work to be done, each is essential to the complete organization, and the result is both new and highly useful."

The Court was there dealing with pearl, a substance so hard that its cutting tool had to be sharpened, or, as Judge Acheson said,

"the extreme hardness of the material speedily dulls the edge, and constant resharpening of the tool is necessary. This occasioned much delay, when the old method of cutting pearl buttons was pursued. Moreover, the employment of highly skilled workmen to keep the tools properly sharpened was required."

It followed therefore, that the suspension of the process while the tool was automatically sharpened, was not an isolated operation but a link in the chain of unbroken continuity which made the machine a continuous operative combination leading to a unitary product. In Burdett v. Elevator Co., 196 Fed. Rep. 43, affirmed in 197 Fed. Rep. 743, Judge McPherson said:

"The successive operation of the signals and of the motor is not a decisive objection * * * nor need all its movements be simultaneous. The test is whether there is a new unitary result to the production of which the different elements co-act."

These cases were but following the earlier and leading case in this Court, where in the National Cash Register Co. v. American Cash Register Co., 53 Fed. Rep. 367, this Court made the test the fact that each of the elements there involved

"by the co-operation of the others, capacitated to contribute, by acting in its own peculiar way, to the common end, which, without the co-operation of each and every other of the co-ordinated elements, it would be powerless to accomplish or advance."

This principle was further accentuated by this Court in Novelty Glass Manfg. Co. v. Brookfield, 170 Fed. Rep. 948, where the machine for pressing glass insulators involved several successive steps, namely, (1) the gathering boy poured the molten glass into the machine mould; (2) the presser man brought the mould under the actuating rod, by a lever brought down the screw plunger, detached it and left it seated in the molten glass; (3) by the mechanical revolution of the table, the mould passed to another workman, who by a rotary spindle unscrewed the plunger; (4) by another rotation of the table the mould passed to a fourth workman who opened the same, took out the completed machine moulded insulator. All of these operations were themselves old mechanical processes, but no one had ever combined them to produce a machine-made insulator. But even in view of the fact that all the steps were separately old and were thus in a measure isolated and unconnected, the Court held there was a novel combination and use in a machine which produced a new unitary article, to-wit, a machine-made insulator, in that regard saying:

"It is said, however, that the machine is a mere aggregation, the different parts of which are brought together having no combined action, but simply operating in juxtaposition, each by itself as a complete and independent piece of mechanism, under the manual control of separate workmen. And this view is confirmed, as it is urged, by the way the claims are progressively built up, starting out with a certain number of elements and adding one at each step, even the stop or detent to lock the table, and the standard about which it turns, being utilized to that end. But whatever may be said of the attempt so made, of which more anon, the different parts in our judgment sufficiently co-operate to a common end to dispel

any such idea. The test is whether there is a new unitary result, to the production of which the different elements co-act (Bliss v. Reed, 106 Fed. 314, 45 C. C. A. 304; National Tube Co. v. Aiken (C. C. A. 163 Fed. 264) which certainly is the case. The purpose of the mechanism which is brought together is to make glass insulators, and this it most successfully and expeditiously does, a completed article being produced at a single turn. No doubt there are different steps in the operation to which the different parts are successively addressed. But it is not necessary that the insulators shall be made at a single stroke, in which each of the parts shall be involved. That may be desirable, and through the genius of some one, if the nature of the material permits, may possibly be attained. But for the present, a machine which embodies and is adapted to carry out the process, as it is understood and supposedly has to be performed, in which there are distinct parts for the several steps, is not to be condemned as an aggregation on that account."

To our mind, none of these cases,—the interjection of the tool sharpener in the cutting of the pearl button lathe, a mechanical interruption and segregation of the cutting process, but still one essential in the wear and tear of a tool cutter against the hardness of pearl; the signal and motor of the elevator; the successive and distinct stages of the glass insulator machine mould,—present as clear a case of co-acting, combining elements as the present one, the gist of which is the rapid rotation of the core and its resultant radial stretch acted upon by the self-adjusting, spinning rolls. To our mind, the combination in the present case is more marked because in it there is no isolation of stages, but related continuity of action in rapid rotation and co-ordinated roll spinning, to produce the unitary result. As soon as rapid rotation begins, roll spinning also begins and utilizes the rapid rotation to enable the rolls to plaster an unpuckered, radially distended diamond shaped fabric upon the core. To our mind, there could be no clearer and more distinctive characteristic example of combination afforded as the basis for a true combination claim, than is evidenced by the present machine. While in no sense were the elements of rapid rotation, varied stretch of fabric at different zones, spinning rolls and centrifugal force, as an abstract principle, new in themselves, we are satisfied that the utilization of centrifugal force to stretch the fabric and the action of the spinning rolls upon a centrifugally, automatically stretched fabric, was an entirely new combination which State brought into the tire art.

As we have said before, State's was the first successful machine in this country to make a double stretched automobile tire by machinery. It is contended, however, that what he did was anticipated by the Belgian Patent No. 194,731, granted September 20, 1906, to Alphonse Matherne, for a machine and process for mechanically manufacturing casings for pneumatic tires. Without entering into minute details, it suffices to say that by certain mechanism Matherne proposed to unwind the fabric which is advanced to the core, and to stick or plaster it to the tread circumference, or, as the patent

states, "as the fabric is pulled along and unwound from the drum 18 it encounters the rollers 30 on the casing 28 * * * each of these rods carries at its extremity a roller 30 which advances and retracts on the core, so as to stick to its straight or convex sides the fabric which has been placed there." In addition to thus plastering the tread portion and thereby lengthening the fabric along the line of the median circumference of the core, the outer or free edges of the fabric were lessened in length by a process of crimping, which is described in the patent as follows:

"The fabric on leaving the drum passes between two rolls that are spherical or oval in form and arranged in such a manner as to produce a slight lengthening of the middle of the fabric, which lengthening greatly facilitates the removal of the puckers. On the same support there is mounted at each side, two conical gears 36, the sole purpose of which is to produce a slight, uniform puckering of the fabric strips at their edges, ensuring in advance a uniform contraction of the fabric at all points."

Now it will be observed that at this stage, while there is lengthening of the median line of the fabric by circumferentially stretching, there is no contraction of the outer edges by radial stretching. It is true, the edge of the fabric has been crimped or puckered, but this puckering, while it has shortened the line by forming puckers, has not changed the square of the fabric into a radial diamond-shaped interstice, as is the case in State's machine. Moreover, this puckered edge or skirt was not left free as in State, but was plastered down by Matherine to the side of the core, in that regard the patent saying:

"The fabric is placed on the core, which is coated with a layer of rubber solution so that the fabric adheres well to it and may be pulled along by its rotary movement".

To smooth out the designedly formed puckers or wrinkles on the cemented edge of the fabric, Matherne provides a forked tool which has a rounded roller set at an angle on a sliding tool carrier. The operation is thus described:

"On the support 17, which constitutes a tool carrier there is mounted a tool like that shown in Fig. 6 which has a fork with a rounded roller set at an angle. The sliding tool carrier 17 is adjusted so that the roller comes to the level of the top of the core. Then the machine is set in operation and the roller is caused to descend progressively on the side of the core and all the way down to its base. Thus there is obtained the complete and rapid removal from the fabric of the puckers, the descending motion being produced automatically by the pawl 34. Both sides may be readily worked at the same time, by mounting two tools like that shown in Fig. 6, on the sliding tool carrier 17. * * * This last device (the tool of Fig. 6) has a great advantage in being manually controlled, whereby it has the capacity of easily passing over the beads."

We cannot accede to the contention that Matherne's disclosure had the effect of destroying State's practically operated and highly suc-

cessful machine. There is no evidence that the machine in the form disclosed by Matherne had any effect on the art. In point of fact, he suffered the patent to lapse in default of the first payment required after its issue, and when he subsequently obtained a German patent he abandoned his rollers and adopted another form of mechanism. But wholly apart from these considerations, we feel that Matherne did not touch upon or solve the problem overcome by State. In the first place, he deliberately formed puckers and then sought to eliminate them, a procedure wholly different from State, who never formed puckers, and indeed prevented their formation by radial stretch and radial diamond pointed interstices. Matherne plastered his puckers to the core without stretch, and thereafter sought to roll out the puckers. State, on the other hand, left the skirts of his fabric free, and stretched those fabric edges into radial diamond-shaped interstices by the use of high-speed core rotation. Indeed, the whole process of Matherne, so far as the side and inside or bead zone of the fabric was concerned, was simply the use of a hand roller to iron out the puckers he had deliberately formed and plastered on the core. Had the art stopped with Matherne's proposed machine, the auto tire art would not have had the impetus brought about by State's disclosure.

Seeing then, that State's contribution to the tire-making machine art was novel and useful, that it passed into general use and that its worth and the validity of his patent have been acquiesced in by large numbers of manufacturers in the automobile industry, who naturally would not pay tribute unless they were satisfied of the validity of his patent, we turn to the question whether such a meritorious patent is to be invalided as held by the Court below, on account of the disclaimer State filed after the decision in the Sixth Circuit. We cannot give the disclaimer that effect.

Experience has shown that very often applicants for patents, impressed by the seeming importance of their own inventions, have made statements and claims which time and closer knowledge of the art show are unwarranted. In relief of such common mistakes, the disclaimer statutes allow a patentee to seasonably avow such unwarranted statements and unjustified claims, and to restrict and narrow his application to the limits of the real, novel, disclosure he made, and to confine his claims to that limit. Where a disclaimer is filed in good faith, and no attempt is made thereby to broaden or make more inclusive the original disclosure or claims, the law looks with favor on such procedure. In this case, there is no element of fraud, bad faith or an attempt to broaden the disclosure or claims, but an honest effort to eliminate from the specification and the construction of the claims all elements save those which constituted the true disclosure State gave the art.

Broadly speaking, the essence of State's invention consisted of the combination of a power-driven core, with spinning rolls mounted on a radial, moving support, the rolls being so laterally spring-pressed as to compel them to follow the lessening contour of the shoe down to the bead edge. The Court of Appeals of the Sixth Circuit had held

that it was an aggregation to claim a tread roll in combination with the spinning rolls, and the disclaimer withdrew all claims embodying the tread roll, namely, 8, 9, 10, 11 and 14, and also claims 15, 16 and 17, which related to other subsidiary features not connected with those features which make up the essence of the patent. All of these claims disappeared from the patent and are not involved in this case, and such a course of procedure has the warrant of judicial approval: O'Reilly v. Morse, 15 Howard, 62; Sessions vs. Romadka, 145 U. S. 41.

As to the claims which are here in suit and which embody the essential elements of State's disclosure, there was no abandonment of them but simply an assertion of and emphasis upon those vital elements which we have indicated. For example, take claim 22*, which embodies the elements of, first, a power-driven ring core; second, a radially moving support laterally power-pressed toward the core; and third, a spinning roll mounted on a support for passing radially along the sides of the tire-shoe, to shape the sheet of fabric on the core. The effect of the disclaimer is to restrict the operation of these elements to that part of the ring core beyond the tread portion. In that respect, the disclaimer states that in respect to Claim 22,

"I hereby disclaim any combination of the recited elements except when constructed and co-ordinated for shaping and applying a previously unshaped sheet fabric strip to that part of the recited ring-core beyond the tread portion, and unless the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning roll in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith."

The question of infringement is confined to a narrow limit. The essential elements of State's machine are found in the defendant's machine. We have the rapid rotation of the core. We have the loose edges, stretched by the centrifugal force induced by rapid core rotation. We have a radially moving tool support, and those tools laterally power-pressed not by the spring of State's machine, but by a weight which functions in the same way to bring the spinning rolls into one continuous shifting play, and the whole machine devised to adapt and combine in the same mechanical way State disclosed, the use of spinning rolls, co-operating with centrifugal radial stretch of the fabric to produce the unitary machine-made product, which State first made possible in the art.

*"22. An open tire-shoe making machine comprising the combination of a sheet-fabric supply, a power-driven ring-core, a radially moving support laterally power-pressed toward the core, and a spinning roll mounted on the support for passing radially along the sides of the tire-shoe to shape the sheeted fabric on the core, substantially as described."

We are, therefore, of opinion the Court below committed error in the entry of its decree, that its decree should be vacated, and the case remanded with instructions to enter a decree finding the claims here involved valid and infringed, and directing an accounting.

Dissenting Opinion.

[Filed Oct. 19, 1922.]

DAVIS, *Circuit Judge,* dissenting:

I regret that I am constrained to dissent from the conclusions of my colleagues. The Circuit Court of Appeals for the Sixth Circuit found that the patent in question disclosed a mere aggregation and not a patentable combination. Firestone Tire & Rubber Co. v. Seiberling, 257 Fed., 74. In view of the fact that Seiberling really presented his case on the theory that State discovered a new method of making tire casings or a new set of functions to be performed by associated mechanism, the court did not rest its decision upon invalidity, based upon aggregation, but held that he had nothing "broadly new either in his method or in his selected tools." Thereupon Seiberling, the assignee, filed a disclaimer in which he stated that he had reason to believe that through inadvertence, accident or mistake the specification and claims of the letters patent were in part too broad, including that of which State was not the first inventor, but what reason he had or what the inadvertence, accident or mistake was, or which of these, that caused the patentee to claim more than that of which he was the first inventor, he does not state.

Claim 22 which may be used as typical is for a "tire-shoe making machine comprising in combination": 1. A sheet-fabric supply; 2. A power-driven ring core; 3. A radially moving support laterally power pressed toward the core; and 4. A spinning roll mounted on the support at a receding angle to the plane of the core for passing radially along the sides of the tire-shoe to shape the sheet fabric on the core. The claim is for a machine pure and simple. The purpose of the patent was to do by machine what had before been done by hand, and for such a machine a patent may be granted. Conroy v. Penn Electrical & Manufacturing Co., 159 Fed., 943. The function of the elements is stated but there is not a word in any claim of the patent about the method of operation of any element. Seiberling disclaimed entirely claims 8, 9, 10, 11, 14, 15, 16 and 17, on the ground that they contained that of which State was not the first inventor. Claim 8, for instance, contained a machine comprising: 1. A sheet fabric supply; 2. A power-driven ring-core; 3. A radially movable tread-forming roll for shaping the outer portion of the tire; 4. A radially moving support laterally spring-pressed against the core; and 5. A spinning roll mounted on the support to pass radially along the sides of the tire-shoe to shape the sheeted fabric on the core. In this claim which is admittedly too broad and contains that of which State was not the first inventor, there are the identical elements com-

prising claims 4 and 22, which represent the two groups of claims of the patent. In other words, the claims unqualifiedly disclaimed contain the substance of those not disclaimed. Seiberling has put himself in the inconsistent position of disclaiming in one claim the identical thing which he claims in another on the ground that State did not invent the former but did invent the latter. Again, the part retained is not "definitely distinguishable from the parts claimed without right." They are the same thing.

The elements remaining after the disclaimer was filed are not only a new combination but they are invested with a distinct method of operation not claimed in the old combination. This method of operation, prescribed by the disclaimer, is a distinct addition to the claims, expressly made to avoid the effect of the opinion of the Circuit Court of Appeals of the Sixth Circuit and the disclosures of the Belgian patent (first discovered by the patentee during this litigation) No. 194,731, issued to Matherne November 20, 1906. Seiberling disclaimed any "combination of the recited elements except when constructed and co-ordinated for shaping and applying the previously unshaped sheet fabric strip and unless the power-drive for the ring-core functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning-roll in its radial movement and while pressed toward the ring-core, functions by a gradual action upon such centrifugally thrown out fabric to shape it to the side of the rotating core." He thus tried to avoid the conclusion that his machine was a mere "aggregation" and endeavored to reconstruct and co-ordinate the elements of the new combination so as to have them co-act and conjointly produce the result claimed for the machine. The effect of the disclaimer is to retain in part the machine patent and add to it a method of operation. To this extent the character of the patent is changed to a method patent. The disclaimer is a virtual restatement of the claims changing their character from a simple machine to a new combination machine whose elements operate according to a prescribed method. This may not be done by a disclaimer. Enameled Metals Co. v. Western Conduit Co., et al., 269 Fed., 620; Hailes v. Albany Stove Co., 123 U. S., 582, 587. If claims may be changed so that a combination of elements constituting a simple machine may be modified and formed into a new combination and the elements given a prescribed mode of operation by a disclaimer, it is difficult to know what function a reissue performs. This suit may not be maintained by virtue of Section 4922 of the Revised Statutes. The disclaimer invalidates the patent and the decree dismissing the bill, in my opinion, should be affirmed.

[File endorsement omitted.]

In the United States Circuit Court of Appeals for the Third Circuit, October Term, 1922.

No. 2862 (List No. 55).

[Title omitted.]

Decree.

[Filed Oct. 19, 1922.]

Appeal from the District Court of the United States for the District of New Jersey.

This cause came on to be heard on the transcript of record from the District Court of the United States, for the District of New Jersey and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged and decreed by this Court, that the decree of the said District Court in this cause be, and the same is hereby vacated, and the case remanded with instructions to the said District Court to enter a new decree holding the claims here involved valid and infringed, and directing an accounting and the issuance of an injunction. Victor B. Woolley, Circuit Judge. Philadelphia, October 19, 1922.

[File endorsement omitted.]

[Title omitted.]

Received & filed Nov. 16, 1922. Saunders Lewis, Jr., Clerk.

United States Circuit Court of Appeals for the Third Circuit.

[Title omitted.]

Petition for Rehearing.

[Filed Nov. 16, 1922.]

The John E. Thropp's Sons Company, defendant-appellee, respectfully petitions this Court for a re-argument of the above case, decided October 19th, 1922, and assigns as reasons therefor the following:

I.

That in the opinion of this Court, it is held that the dominating feature of the invention of the patent in suit consists in rotating the core at such high speed that centrifugal force, generated thereby, acts upon the outflying edges of the fabric to automatically stretch

the same radially and contract them circumferentially. This feature is frequently referred to in the opinion as, for instance, on page 10, where it is said:

"But here he [State] changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel [core] and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial diamond-shaped interstices, which contracted the normal length of the fabric."

and on page 9 this Court said:

"the crux and dominating functional feature of State's machine is the use upon the fabric of a centrifugal force caused by rapid rotation, a process which is wholly different from the original hand process,"

and again on the same page:

"there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the consequent exercise of centrifugal force on the covering material, by which it is automatically gradually stretched radially."

and on page 16:

"we are satisfied that the utilization of centrifugal force to stretch the fabric and the action of the spinning rolls upon a centrifugally, automatically stretched fabric, was an entirely new combination which State brought into the tire art."

and on page 18:

"State, on the other hand, left the skirts of his fabric free, and stretched those fabric edges into radial diamond-shaped interstices, by the use of high-speed core rotation."

With respect, it is submitted that there is no evidence in the record to support this basic holding and, for this reason, we have felt fully justified in attaching to this Petition affidavits of the professors of mechanical engineering at the University of Pennsylvania, Columbia University, and Stevens Institute of Technology, in order to demonstrate to this Court the fact that the above recited holdings are based upon a misinterpretation of the action of centrifugal force as established by the laws of physics. If this understanding of the Court to the effect that centrifugal force automatically produces the radial stretch had been based upon evidence in the record, we should not have felt at liberty to resort to the practise of attaching the said affidavits to this Petition; but, as this holding was apparently based upon what the Court felt was a matter of common knowledge in respect to the physical effect of centrifugal force, it has seemed to us

justifiable to submit these affidavits made by men of unquestioned ability in order to establish that this thought of the Court involves a misapprehension, and to request that, in case the Court still entertain any doubt as to this fact, the cause be remanded to the District Court with directions that the same be reopened for testimony on this point. These affidavits show that this holding of the Court is contrary to said established laws of physics and imputes to centrifugal force a function which it does not and cannot have. The effort of centrifugal force is to stretch the said outflying skirts circumferentially and, in any event, the amount of centrifugal force, at any core speed which is commercially practicable (e. g., 120-130 R. P. M.), is so trivial as to have no actual stretching effect upon the fabric in any direction.

It is not understood that plaintiff-appellant has even contended that centrifugal force per se acts to produce radial stretch and circumferential contraction. The witness Browne did describe the outflying fabric skirts or edges as being, in effect, held out by invisible fingers (Rec. p. 37), but he agreed, on cross-examination, that this was merely a figure of speech (Rec. p. 83).

"A. Of course, the 'invisible fingers' is a figurative expression, and has reference rather to the direction in which the skirts are standing out, than to the actual direction of the centrifugal force."

For this reason, defendant did not put in any evidence to show that centrifugal force actually has no stretching effect and that, if it had, its tendency would be toward circumferential, not radial, stretch.

In this same connection, the opinion of this Court finds that the spinning rolls merely act to apply or cement to the sides of the core the fabric which has been automatically radially stretched by centrifugal force. Thus, it is said in the opinion on page 10, after describing the radial stretch of the fabric skirts or edges by centrifugal force:

"as the [spinning] rolls revolved they engaged and pushed inward and against the sides of the core the stretched flying skirts of the fabric. Thereby he then, and by the wheels, pressed and cemented the radially stretched and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge."

And again on the same page, it is said that the springs caused the spinning rolls

"to automatically press the automatically stretched and loose fabric, or skirts, in an unwrinkled state, on the bead of the lower surface of the core."

On page 15, in describing the combination of the patent in suit, the opinion of this Court says:

"the gist of which is the rapid rotation of the core and its resultant radial stretch acted upon by the self-adjusting, spinning rolls."

and again on the same page:

"As soon as rapid rotation begins, roll spinning also begins and utilizes the rapid rotation to enable the rolls to plaster an unpuckered, radially distended diamond shaped fabric upon the core."

On page 18, it is said that State

"never formed puckers, and indeed prevented their formation by radial stretch and radial diamond pointed interstices."

It appears from the annexed affidavits that the centrifugal force does not produce the radial stretch, so that the spinning rolls cannot act to press fabric which has already been automatically radially stretched against the sides of the core. Such radial stretch as takes place is necessarily accomplished by the inward mechanical push of the spinning rolls themselves, and it is understood that this has always been the contention of the plaintiff, the argument being that centrifugal force held the fabric away from the core so that the spinning rolls could get a better grip upon it. There are statements by plaintiff's expert Browne with respect to using enough centrifugal force to bring about radial stretch, but they are always accompanied by words to the effect that the radial stretch is produced by the inwardly moving spinning rolls.

The fact that the fabric which the spinning rolls press against the core is not one which has been automatically radially stretched so as to eliminate the formation of puckers is fully shown by Plaintiff's Exhibit 35, photographs of State machines, which are reproduced on pages 189, 191 of Volume II of the Record. In these pictures, particularly photograph No. 2 on page 191, are shown an abundance of puckers in the unattached fabric, and it is admitted by plaintiff's witness Trogner that this photograph No. 2 shows a condition in which the spinning rolls have just about completed their inward radial movement on the outer layer of fabric (Rec. p. 626, Q. 28). This photograph shows not only the outer layer, but two or three inner layers, the spinning operations upon which have necessarily been completed, and which plainly embody a multitude of puckers or wrinkles. The operation of laying down the remainder of the puckered or wrinkled fabric is performed by hand (Rec. p. 234, line 30). This situation is well explained in the uncontradicted testimony of defendant's expert Waterman as to the operations of these machines which he witnessed at the Goodyear plant where the commercial machines were exhibited to him by plaintiff's counsel and expert (Rec. p. 230, Q. 16). Mr. Waterman said, at the bottom of page 233:

"In practically every layer of fabric applied very large and very bad wrinkles were formed and it was necessary to stop the machine and lift up the fabric and smooth it down by hand with a spade, after having applied cement underneath in some instances."

As the exhibit photographs above referred to were presented by plaintiff, and as the exhibition of the commercial Goodyear machines was given to defendant's expert for the purpose of his testimony in this case, it may be assumed that the photographs and exhibition represented plaintiff's case in the best light. Therefore, the unquestioned fact of the presence of abundant wrinkles or puckers in the fabric after the high speed rotation and even after the operation of the spinning rolls, conclusively shows that the centrifugal force does not radially stretch the fabric so as to contract its circumferential length and bring it into the proper form to smoothly fit the core, as well as that the spinning rolls certainly have something more to do than merely to cement or attach an automatically, centrifugally, radially stretched fabric to the core. A comparison of the said exhibit photographs of the Goodyear machines with photographs Nos. 10 and 11 comprising part of Defendant's Exhibit D, photographs of the operation of the Belgian machine, shows that the conditions are essentially the same.

It may be added, with emphasis, that the patent nowhere suggests any radial stretch as being produced by centrifugal force, and this although the application for patent was not filed until a year and a half after State claims to have developed the Goodyear commercial machine.

If it be conceded that centrifugal force does not automatically, radially stretch the fabric as repeatedly set forth in the Opinion: then there is nothing to distinguish the asserted invention of State from the Belgian patent or the prior hand spinning.

II.

The decision of this Court bases the novelty of the invention upon a high speed rotation of the core, which is not a structural feature, and is so indefinite that no line can be drawn between infringement and non-infringement. Defendant cannot tell, nor can any one else tell, how fast it can rotate the core without infringing. The same machine might be infringing at ten o'clock in the morning and non-infringing at eleven o'clock, according to variations in the speed of the drive, or variations in the size of cores placed thereon, since, even at the same speed, centrifugal force varies with the diameter of the core. Such indefiniteness of claims renders them void under the Statute. Minerals v. Butte, 250 U. S. 336. As said by the Court in Bullock v. General, 149 F. R. 409, 417:

"Or suppose the artisan wishes to construct a ventilated armature, and does not care to use Reist's separators, how shall he know in what manner he shall avoid the Reist patent? How thin must his separators be to do this? Or suppose a purchaser wishes to buy one. He must look out for the patent. By what test or comparison shall he be guided? These inquiries enforce the rule that the patentee must describe with sufficient certainty the particulars of his invention so that the artisan and the public may know the char-

acter and limits of it, and how it is to be distinguished from others which the one may make, or the other purchase, in safety."

The only speed of core rotation mentioned in the patent is 207 R. P. M. (Pat. p. 2, line 4), and this is impractical and far higher than anything used by plaintiff or defendant in commercial operations (Rec. p. 231, p. 271, bottom, p. 41).

III.

Although the defense of joint invention was not referred to in the Opinion, it is assumed that the same was considered by the Court and overruled, so that we do not discuss that question here or argue any of the other matters which were embodied in the briefs originally submitted, but simply base this Petition upon the respectful submission that the Court has fallen into a manifest error with respect to the action of centrifugal force, which error controls the decision of the case.

Your Petitioner believes that this Honorable Court erred in the points above named, and, as the decision sustaining the patent was based thereupon, it

Therefore prays that a rehearing may be had on the said points and that a time may be set therefor; and that the issuance of the Mandate herein be stayed pending a decision on this Petition.

Your Petitioner also moves that, if this Court entertains any doubt as to the fact with respect to the effect of centrifugal force, this case be remanded to the District Court with direction to reopen the same for the taking of proofs on this point. The John E. Thropp's Sons Company, By Peter D. Thropp, Vice-President. E. Clarkson Seward, Thomas G. Haight, Counsel for Petitioner.

State of New York,
County of New York, ss:

Peter D. Thropp, being duly sworn on oath, says:

That he is Vice President of The John E. Thropp's Sons Company, the defendant-appellee and petitioner herein; that he has read the foregoing petition and knows the contents thereof; that the matters therein stated are true, so far as such matters are within the knowledge of deponent, and as to all other matters therein stated, the same are true to the best of deponent's information and belief.

That the reason why this verification is not made by the petitioner in person is that the said petitioner is a corporation. Peter D. Thropp.

Subscribed and sworn to before me this 16th day of November, nineteen hundred and twenty-two. F. George Barry, Notary Public, Westchester Co., N. Y. (Seal.) Certificate filed in New York Co.

We hereby certify that the foregoing petition for a rehearing is, in our opinion, well founded in point of law, and is not interposed for

purposes of delay. E. Clarkson Seward, Thomas G. Haight, Counsel for Petitioner.

In the United States Circuit Court of Appeals for the Third Circuit.

No. 2862.

Frank A. Seiberling, Plaintiff-Appellant,

v.

The John E. Thropp's Sons Company, Defendant-Appellee.

Affidavit.

State of Pennsylvania,
County of Philadelphia, ss:

William H. Kavanaugh, being duly sworn, deposes and says as follows:

I am professor of experimental engineering at the University of Pennsylvania, and have held this position for about six years. Previous to coming to the University of Pennsylvania, I was for nine years professor of experimental engineering and head of that department at the University of Minnesota.

The opinion of his Honor, Judge Buffington, in the above entitled case, has been called to my attention, particularly with respect to the holdings as to the effect of centrifugal force upon the edges of the tire fabric which are outflying from the core, and I have been asked to state whether or not centrifugal force acts as recited in the opinion, particularly with reference to that portion where it is stated:

"But here he changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric."

In preparing myself to answer this question, I have carefully read the opinion, and have spent an entire day in a tire factory observing the operation of one of the defendant's tire making machines. In this machine, the fabric is stretched onto the tread portion of the core while the latter is rotated at a speed of 13 RPM, and is spun down on the sides of the core while it is rotated at 130 RPM, by spinning rollers which move radially with respect to the core and are laterally pressed toward the same by weights. I have very carefully examined the operations and the effect upon the fabric with respect to circumferential and radial stretch.

It is a fact that centrifugal force, which is generated during the rotation of the core at high speed, does not act in such a direction as to even tend to produce radial stretch in the outflying edges or skirts of the fabric. On the contrary, the fact is that the tendency of centrifugal force is to circumferentially stretch the said edges of the

fabric. This is because each of the said outflying edges is in the form of a cylindrical, endless band, which band centrifugal force tends to make larger during the rotation at high speed of the core. Thus, if the centrifugal force were powerful enough to produce any stretch, it would be a circumferential stretch which would tend to make the interstices of the fabric diamond-shaped with the long axes circumferentially disposed, and to increase the circumferential length of the fabric instead of contracting it. The foregoing are physical facts which require no inspection of the operation of making tires to establish. Furthermore, the amount of centrifugal force which is generated as a result of rotating a core adapted for making a tire about 35 x 4½ in size at 130 RPM is insignificant and utterly impotent to produce any stretch in the outflying skirts of the fabric. It actually amounts, in a tire of the size stated, to approximately 0.168 ounces for each square inch of fabric in the flying skirt. The circumferential stress or pull developed in the skirt by this centrifugal force is only 2.562 ounces per inch of the skirt width. I have made tensile tests of this fabric which show that a stress or pull of this amount stretched or elongated the fabric less than ⅛ of 1 per cent; which is a negligible amount, and which is, moreover, against radial stretch.

I state with complete confidence that any radial stretching which may be produced in the manufacture of tires as described, is the result of mechanical action of the spinning rollers, and is in no way accomplished by centrifugal force, since, as already stated, the latter acts in an opposite direction and could not possibly produce a radial stretch and circumferential contraction, either or both. There is no analogy between the endless band which constitutes the outflying edge of the fabric, and a strip or ribbon of fabric which might be secured to the core and permitted to fly out radially therefrom. Aside from well-known considerations, this may be illustrated by the fact that, before the fabric edges could ever get into such outflying radial position, they would have to be circumferentially stretched 20.1 inches in a tire of the size mentioned above. This would require that the fabric be stretched about 20 per cent.

I am compelled to state, with the greatest respect, that the numerous references in the opinion of his Honor, Judge Buffington, to the radial stretching effect of centrifugal force, necessarily imply a misinterpretation of the physical force at work, since its action is the opposite of that recited in the opinion.

Subscribed and sworn to before me this — day of November, nineteen hundred and twenty-two.

United States Circuit Court of Appeals for the Third Circuit.

No. 2862.

FRANK A. SEIBERLING, Plaintiff-Appellant,

v.

THE JOHN E. THROFF'S SONS COMPANY, Defendant-Appellee.

Affidavit.

STATE OF NEW YORK,
County of New York, ss:

George B. Pegram, being duly sworn, deposes and says as follows:

I am Professor of Physics in Columbia University where I have been on the staff of the Department of Physics for twenty years, the past eight years as Professor of Physics. I am also dean of the engineering school of Columbia University. I have been teaching the subject of mechanics for twenty years.

I have read the opinion of his Honor, Judge Buffington, in the above entitled case and have read also parts of the Record on Final Hearing, Volume II, Exhibits, and parts of the Brief for Plaintiff-Appellant. In the opinion in this case statements are made as to the part played by centrifugal force in the operation of the plaintiff's tire making machine, which statements assign to centrifugal force the role of radially stretching by distortion of the mesh and thereby circumferentially contracting the loose fabric or skirt prior to its being pressed down and caused to stick to the form by the action of the forming wheels or rollers. I refer particularly to the following portions of the opinion:

Page 9:

"there is a gradual and uniform, and indeed an unbroken spiral sequence caused by the rapid rotation of the core and the consequent exercise of centrifugal force on the covering material, by which it is automatically gradually stretched radially."

Page 10:

"But here he changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric."

"as the rolls revolved they engaged and pushed inward and against the sides of the core the stretched flying skirts of the fabric. Thereby he then, and by the wheels, pressed and cemented the radially stretched and therefore puckerless fabric against the lessening sides of the shoe clear down to the bead edge."

Page 15:

"the gist of which is the rapid rotation of the core and its resultant radial stretch acted upon by the self-adjusting, spinning rolls."

Page 16:

"we are satisfied that the ultilization of centrifugal force to stretch the fabric and the action of the spinning rolls upon a centrifugally, automatically stretched fabric, was an entirely, new combination which State brought into the tire art."

The problem of finding the exact form which a mesh fabric of threads which are by no means inelastic, such as that applied in the making of tires, will assume under the action of centrifugal and other forces is not a simple one, but I can say definitely that in the operation of the plaintiff's tire making machine centrifugal force cannot act in such a way as to change the shape of the meshes of the fabric skirt by "radially" elongating them and "circumferentially" shortening them. The first effect produced by centrifugal force on the loose skirt is to smooth out the ruffle by causing the skirt to assume the form of a surface of revolution. Thereafter the centrifugal force tends to pull all parts of the loose fabric farther away from the axis of rotation. Let us imagine circumferential stripes marked on the flying skirt or band of the fabric. Any one of these stripes is, of course, being urged away from the axis of rotation by centrifugal force, but if it is to move farther away from the axis the stripe must be lengthened circumferentially. Circumferential lengthening by distortion of the mesh is necessarily accompanied, however, by radial shortening of the mesh. If the flying skirt, attached at its inner edge, were in the plane of rotation, it is obvious that the motion of any stripe away from the axis would result at one and the same time in circumferential elongation of the mesh and in radial elongation of the mesh; but this simultaneous stretch in both directions is impossible of attainment by simple distortion of the mesh. Consequently in this case centrifugal force could produce no distortion. In the actual case, however, the flying skirt or band of the fabric forms a surface which is far from lying in the plane of rotation, being at the beginning of the spinning operation approximately a cylinder perpendicular to the plane of rotation. In this case a stripe of the material could move under the action of centrifugal force farther away from the axis by circumferential lengthening and corresponding radial shortening of the mesh, provided the band tilted up toward the plane of rotation, since this change of angle would enable the band of fabric as a whole and in every part to get farther away from the axis of rotation without having to increase in width and even while undergoing a decrease in width corresponding to the required circumferential elongation.

Thus the primary and necessary condition for any yielding of the band to centrifugal force is a circumferential stretch, which stretch if due to mesh distortion is just as necessarily accompanied by "radial" contraction. With all respect, I am compelled to state

that the effect of centrifugal force in distorting the mesh of the band of fabric would therefore be the opposite of that stated in the opinion.

I may say further that it does not appear to me that the centrifugal force at such speeds as are used by the plaintiff would be great enough to produce any appreciable distortion of the mesh of this rather firm fabric. At a speed of 120 revolutions per minute and a radius of 18 inches the centrifugal force on any part of the fabric would be only about seven times its weight. George B. Pegram.

Sworn to and subscribed before me this 16th day of November, nineteen hundred and twenty-two. Charles S. Danielson, Notary Public, Westchester County. (Seal.) Certificate, New York County No. 91, New York Register No. 3090. Term expires March 30, 1923.

United States Circuit Court of Appeals for the Third Circuit.

No. 2862.

Frank A. Seiberling, Plaintiff-Appellant,

v.

The John E. Thropp's Sons Company, Defendant-Appellee.

Affidavit.

State of New Jersey,
County of Hudson, ss:

Robert M. Anderson, being duly sworn, deposes and says:

I am professor in charge of mechanical engineering at the Stevens Institute of Technology, and have held this position for three years. For the past ten years I have also been professor of engineering practise at the same place.

I have been consulted with respect to the opinion of his Honor, Judge Buffington, in the above matter, and particularly with respect to that part of the opinion in which he says:

"But here he changed to something the old hand process had never used, namely, the machine was speeded up to a point where the revolution of the wheel and flying skirt of the uncemented loose fabric stretched itself radially and formed thereby radial, diamond-shaped interstices, which contracted the normal length of the fabric."

I understand that, in manufacturing automobile tire casings of woven fabric, a strip which is cut on the bias and impregnated with rubber, is circumferentially stretched about the iron core so as to cause it to conform to and adhere to the outer or tread portion thereof; and that this is done while the core is rotated at comparatively low speed, such as 12 or 13 RPM. This circumferential stretching of the fabric naturally changes the square meshes thereof into diamond shaped meshes on the outer periphery of the tire, which have their long axes circumferentially disposed. I under-

stand that the unattached edges of this fabric strip are smaller in circumference than the outer periphery of the core.

Following this procedure, I understand that the speed of the rotation of the core is increased to 120 or 130 RPM., so that the edges of the fabric fly out and take a position substantially at right angles to the plane of the core, and that the said edges of the fabric are then smoothed down on the sides of the core by spinning rolls which are moved inwardly in a radial direction while pressed towards the sides of the core.

I gather from the opinion of his Honor, Judge Buffington, and, specifically, from the passage above quoted, that he believes the effect of centrifugal force during high speed rotation of the core is to stretch the side edges of the fabric radially and change the meshes of these parts of the fabric into diamond shapes with the long axes radial, thereby contracting the length or circumference of the edges of the fabric.

With respect, I must say that this involves misinterpretation of the action of centrifugal force, since the action thereof on the free outflying edges of the fabric would tend to enlarge the circumference of the same and thereby bring about circumferential stretch. In other words, if the centrifugal force generated is enough to have any stretching effect upon the fabric, it will be to stretch the same circumferentially and change the square meshes to diamonds with the long axes circumferential, instead of imparting a radial stretch and contracting the length or circumference of the fabric. This is based upon established facts in physics about which there is no question. I may add that the effect of centrifugal force upon these endless bands constituting the free edges of the fabric, is not at all the same as its effect would be upon a ribbon or strip of fabric secured to the core and permitted to fly out radially in the plane of the core or parallel thereto. The side edges of the tire fabric cannot fly out into any position in the plane of or parallel to the plane of the core without being circumferentially stretched to a very decided extent.

With great respect, I am positive in the assertion that, under the conditions of tire manufacturing described, centrifugal force can have no tendency to cause the fabric to stretch itself radially and thereby form radial diamond shaped interstices which contract the normal length of the fabric, as stated by his Honor, Judge Buffington. Robert M. Anderson.

Subscribed and sworn to before me this 16th day of November, nineteen hundred and twenty-two. Adolph H. Geigir, Notary Public, N. J. (Seal.)

United States Circuit Court of Appeals for the Third Circuit.

[Title omitted.]

Memorandum by Plaintiff-Appellant in Opposition to Petition for Rehearing.

[Filed Dec. 1, 1922.]

Plaintiff-appellant opposes the petition by defendant-appellee for re-argument on the ground that the point advanced is not only without proper foundation but also immaterial.

Lack of Foundation.

The entire matter is based on isolated and incomplete portions of the opinion, quoted without their context, and with emphasis so stressed as to give them a strained and unintended meaning. Petitioner in substance alleges that these passages indicate that the Court ascribes the stretching and shaping of the fabric skirts to centrifugal force alone, and held this to be "the dominating feature," and that, therefore, its finding is based on a misapprehension of the invention. Both the premise and conclusion are without foundation. Petitioner does not deny the new result which State accomplished,—obviously it cannot do so,—but says the Court found it due solely to the centrifugal effect. In opposition to this, respondent contends the Court's real finding to be that the shaping and stretching of the fabric and its application to the core are due to the action of all the elements, "all conjointly functioning to produce a unitary machine result which neither of them separately could effect." This language occurs in a passage from the Court's opinion which is in full as follows:

"It will therefore be seen that the *essence of his disclosure* was the rapid, sustained, regular revolution of his core, the use of a shifting platform on which he located his spinning rolls, and the constant, regular and uniform exertion of pressure upon those spinning rolls, causing them to automatically press the automatically stretched and loose fabric, or skirts, in an unwrinkled state, on the head of the lower surface of the core. *If this statement of the process be correct, and there can be no doubt in that regard*, it follows that the process is a unitary one, is a continuous one, is an interrelated one, is an undivided one, and that there is a continuity of uniform, sustained, progressive, advance from the start to the finish of this machine-made tire, which is brought about by the rapid revolution of the core wheel acted upon by the spin of spring-controlled engaging rolls cooperating with the centrifugal force generated by the rapid motion of the core. In other words, united, cooperating, *conjoint functioning of the core speed and spinning rolls*, effected by roll springs and the shift of roll platform, all conjointly

functioning to produce a unitary machine result which neither of them separately could effect." (Italics ours.)

This was the first specific statement of the Court's position, and it is difficult to see that it could be more explicitly expressed. When the matter was again referred to at later points, and apparently to avoid prolixity, an ab reviated statement was employed, and it is upon these later references that petitioner's contention is based. Had petitioner desired to find them, there are several other precise statements of the cooperative functioning involved, as for instance the following:

"To our mind, the combination in the present case is more marked because in it there is no isolation of stages, but *related continuity of action in rapid rotation and co-ordinated roll spinning, to produce the unitary result.* As soon as rapid rotation begins, roll spinning also begins and utilizes the rapid rotation to enable the rolls to plaster an unpuckered, radially distended diamond shaped fabric upon the core. To our mind, there could be no clearer and more distinctive characteristic example of combination afforded as the basis for a true combination claim, than is evidenced by the present machine." (Italics ours.)

Could anything be clearer that to the mind of the Court the valuable feature was the cooperation of the several distinct elements?

Everywhere the basic finding of the Court is that the State invention involved a true combination:

"Each element acts and has to co-act with its fellows to produce the unitary result and make the unitary product which alone the machine was fashioned and devised to produce."

And again, in referring to previously litigated instances of combination, the Court says that none of them

"present as clear a case of co-acting, combining elements as the present one, *the gist of which* is the rapid rotation of the core and its resultant radial stretch acted upon by the self-adjusting, spinning rolls." (Italics ours.)

And there is much more to the same effect. In the face of positive statements of this character, how is petitioner justified in contending that the Court reached its conclusion by attributing the principal result to centrifugal force alone?

Moreover, the Court's finding in sustaining the State patent is in accord with the language of the disclaimer quoted in the opinion, which similarly sets forth the co-operation of the high speed core and its centrifugal effect with the radially moving spinning roll:

"* * * and unless the power-drive for the ringcore functions by a sufficiently high speed of rotation and consequent centrifugal force to throw the unapplied fabric portion out from the side of the ring-core, while the recited spinning roll in its radial movement and while pressed toward the ring-core, functions by a gradual

action upon such centrifugally thrown-out fabric to shape it to the side of the rotating ring-core while bringing it into adhesive contact therewith."

There is no support anywhere in the opinion for petitioner's contention that State's result of attaching a radially stretched fabric to the core arises from anything other than the combination under discussion, except in the brief phrases quoted, and then only when taken without reference to context and often in mutilated form.

Immateriality.

On the point of immateriality, respondent contends that if the State combination functions to produce the indicated result, and that is not denied, the precise mode of elemental cooperation is immaterial. It is not necessary to apportion the exact amount of result proceeding from the action of each of the elements of the combination, i. e., whether or not the radial stretch is effected entirely by centrifugal force, or entirely by the advancing spinning roll, or partly by centrifugal force and partly by the spinning roll, or in what proportions by centrifugal force and by the spinning roll. It is sufficient to note that the resulting effect is secured by the cooperation of the several elements, each of which acts and has to co-act with its fellows to produce the unitary result," as stated by the Court again and again in one form or another.

In making its case, respondent (plaintiff) attributed the stretching effect to the conjoint action of centrifugal force and advancing spinning roll along the lines indicated by the disclaimer, its working theory being that centrifugal force throws out the skirt of the fabric in unwrinkled condition and under tension, the resistance being sufficient to produce radial stretch as the roll advances, but there was no effort to apportion the merit for the resultant between the parts.

There is in addition a distinct line of analogous authorities, both in the Supreme Court and in this Court, to the effect that a statement of complete mode of action is unnecessary. For instance:

Eames v. Andrews, 122 U. S. 40 (55):

"An inventor may be ignorant of the scientific principle, or he may think he knows it and yet be uncertain, or he may be confident as to what it is, and others may think differently. All this is immaterial, if by the specification the thing to be done is so set forth that it can be reproduced."

Diamond Rubber Co. v. Consolidated Rubber Co., 220 U. S. 428. See particularly page 435 and the cases cited;

Note also the cases in this circuit:

Westmoreland Co. v. Hogan, 167 Fed. 327 (328);
Mead-Morrison Co. v. Exeter Works, 225 Fed. 489 (496);
Gear v. Fairmount Co., 231 Fed. 728 (732);
Searchlight Co. v. Victor Co., 261 Fed. 395 (400).

The Affidavits.

Petitioner has filed several affidavits by college professors of physics, etc. Quite a part from the question of propriety in employing them in a proceeding of this nature, such affidavits serve to emphasize the necessity for careful scrutiny, when experts have their eyes directed only to a single feature and blinded as to others. Cross-examination would have speedily developed the importance of the cooperation and conjoint functioning of the several elements, but apparently all this was religiously kept from the affiants. Respectfully submitted, Robert Fletcher Rogers, Counsel for Plaintiff-Appellant.

In the United States Circuit Court of Appeals for the Third Circuit, March Term, 1922.

No. 2862 (List No. 55).

[Title omitted.]

Sur Petition for Rehearing.

Order Denying Petition for Rehearing.

[Filed Dec. 4, 1922.]

And now, to wit December 4, 1922, after due consideration, the petition for rehearing in the above-entitled case is hereby refused. Per Curiam. Philadelphia, December 4, 1922.

[File endorsement omitted.]

Clerk's Certificate.

UNITED STATES OF AMERICA,
Eastern District of Pennsylvania,
Third Judicial Circuit, set:

I, Saunders Lewis, Jr., Clerk of the United States Circuit Court of Appeals, for the Third Circuit, do hereby Certify the foregoing to be a true and faithful copy of the original record Vol. I and proceedings in this Court in the case of: Frank A. Seiberling, Appellant, vs. John E. Thropp's Sons Co., Appellee, No. 2862, on file and now remaining among the records of the said Court, in my office.

In testimony whereof, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this seventh Day of December in the year of our Lord one thousand nine hundred and twenty-two and of the Independence of the United States the one hundred and forty-seventh. Saunders Lewis, Jr., Clerk of the U. S. Circuit Court of Appeals, Third Circuit. [Seal of the United States Circuit Court of Appeals, Third Circuit.]

[File endorsement omitted.]

Clerk's Certificate.

UNITED STATES OF AMERICA,
Eastern District of Pennsylvania,
Third Judicial Circuit, set:

I, Saunders Lewis, Jr., Clerk of the United States Circuit Court of Appeals, for the Third Circuit, do hereby Certify the foregoing to be a true and faithful copy of the original Volume II (Exhibits) of the Transcript of Record as filed in this Court in the case of: Frank A. Seiberling, Appellant, vs. John E. Thropp's Sons Co., Appellee, No. 2862, on file, and now remaining among the records of the said Court, in my office.

In testimony whereof, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this seventh Day of December in the year of our Lord one thousand nine hundred and twenty-two and of the Independence of the United States the one hundred and forty-seventh. Saunders Lewis, Jr., Clerk of the U. S. Circuit Court of Appeals, Third Circuit. [Seal of the United States Circuit Court of Appeals, Third Circuit.]

Writ of Certiorari and Return.

[Filed Nov. 20, 1923.]

UNITED STATES OF AMERICA, *ss:*

[Seal of the Supreme Court of the United States.]

The President of the United States of America to the Honorable the Judges of the United States Circuit Court of Appeals for the Third Circuit, Greeting:

Being informed that there is now pending before you a suit in which Frank A. Seiberling is appellant, and The John E. Thropp's Sons Company is appellee, No. 2862, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the District Court of the United States for the District of New Jersey, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by the said Circuit Court of Appeals and removed into the Supreme Court of the United States, Do hereby command you that you send without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable William H. Taft, Chief Justice of the United States, the twelfth day of March, in the year of our Lord one thousand nine hundred and twenty-three. Wm. R. Stansbury, Clerk of the Supreme Court of the United States.

[File endorsement omitted.]

United States Circuit Court of Appeals for the Third Circuit.

[Title omitted.]

Stipulation.

It is stipulated by Counsel for the respective parties that the Transcript of record and Proceedings filed in the United States Supreme Court on Petition for Certiorari herein may be taken as and constitute the return by the Circuit Court of Appeals for the Third Circuit to the Writ of Certiorari directed to said Circuit Court of Appeals by the United States Supreme Court, under the date of March 12, 1923. Rogers, Kennedy & Campbell, Solicitors for Plaintiff-Appellant. E. Clarkson Seward, Solicitor for Defendant-Appellee. March 15, 1923.

UNITED STATES OF AMERICA,
Eastern District of Pennsylvania,
Third Judicial Circuit, set:

I, Saunders Lewis, Jr., Clerk of the United States Circuit Court of Appeals, for the Third Circuit, do hereby Certify the foregoing to be a true and faithful copy of the original stipulation of counsel to be used as return to the writ of certiorari in the case of: Frank A. Seiberling, Plaintiff-Appellant, vs. The John E. Thropp's Sons Co., Defendant-Appellee, No. 2862, on file and now remaining among the records of the said Court, in my office.

In testimony whereof, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this nineteenth Day of March in the year of our Lord one thousand nine hundred and twenty-three and of the Independence of the United States the one hundred and forty-seventh. Saunders Lewis, Jr., Clerk of the U. S. Circuit Court of Appeals, Third Circuit. [Seal of the United States Circuit Court of Appeals, Third Circuit.]

[File endorsement omitted.]

JOHN E. THROPP'S SONS COMPANY *v.* SEIBERLING.

CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

No. 185. Argued January 21, 22, 1924.—Decided April 7, 1924.

1. Patent No. 941,962, granted to one State, November 30, 1909, claims 4–7, inclusive, 12, 13, and 22–26, inclusive, for the making of the outer shoes or casings of pneumatic automobile tires composed of woven fabric treated with rubber, is void for lack of invention, viewed either as a mechanical or as a method patent. P. 327.
2. The fact that wide and successful use of a device has been made under license from the patentee may be evidence of patentable novelty, but is by no means conclusive and must be weighed in the light of all the circumstances. P. 329.

284 Fed. 746, reversed.

CERTIORARI to a decree of the Circuit Court of Appeals holding the respondent's patent valid and infringed by the petitioner and reversing a decree of the District Court which dismissed the respondent's bill to enjoin infringement.

Mr. Livingston Gifford, with whom *Mr. E. Clarkson Seward* and *Mr. Thomas G. Haight* were on the briefs, for petitioner.

Mr. Melville Church, with whom *Mr. Luther E. Morrison* was on the brief, for respondent.

Mr. Harry Frease, by leave of Court, filed a brief as *amicus curiae*.

MR. CHIEF JUSTICE TAFT delivered the opinion of the Court.

This is a suit to enjoin the infringement of a patent for the making of the outer shoes or casings of pneumatic automobile tires, composed of woven fabric treated with rubber. We have brought it here because of a conflict of opinion between the Circuit Courts of Appeals of the Sixth and the Third Circuits.

The suit in each Circuit was begun by Frank A. Seiberling, as assignee. That in the Sixth Circuit was filed in 1914 against the Firestone Tire and Rubber Company, and was based on alleged infringement of three claims of a patent to Seiberling and Stevens, No. 762,561, of June 14, 1904, and sixteen claims of a patent to one State, No. 941,962, dated November 30, 1909. The District Judge found both patents valid and infringed, 234 Fed. 370. The Firestone Company appealed and the Circuit Court of Appeals for the Sixth Circuit reversed the District Court, holding that all the claims of the State patent were invalid, and that of the three claims of the Seiberling and Stevens patent, two were invalid and one was not infringed. 257 Fed. 74. The bill in the case before us was brought in 1914 in the District of New Jersey on the same two patents. After the decision in the Sixth Circuit in December, 1918, the plaintiff Seiberling filed in the Patent Office a disclaimer absolute as to eight claims of the State patent and qualified as to the other eleven. No proofs were made in this case to sustain suit upon the Seiberling and Stevens patent, State, the patentee of the other patent, having testified that it had failed. The District Judge dismissed the bill on the ground that the effect of the disclaimers on the State patent was to change it from a machine patent and to make it a method or process

patent, and that the method was old. On appeal to the Circuit Court of Appeals for the Third Circuit, a majority of that court held that the record herein in respect to the State patent was substantially different from that in the Sixth Circuit, and that the State patent as qualified by the disclaimers was valid and infringed. The third Judge dissented on the ground that the disclaimers were of such a character as not to be permitted by the statute.

The making of rubber tires for automobiles began by hand and the proof seems to show that, while power and complicated mechanism have been applied to secure much greater speed in production and possibly greater uniformity in the product, there is even now no successful device for their completely automatic manufacture.

A hand tire was framed on an annular metallic core of the proper size, with spokes and a hub mounted and revolving on a shaft. It was made up of layers of fabric stuck together by a proper adhesive material and formed into a tube with a narrow opening on the inside, called the bead. The ends of the tube were united together to make it circular and endless. The layers were arranged to give a solid rubber tread along the outer periphery to make contact with the road. The workman began by coating the core with a suitable cement, and affixed a strip of the rubber impregnated fabric, stretching it and cutting it so as to cover the circumference of the core. In width it was somewhat less than enough to cover the sides of the core. He then revolved the core slowly, patting and stretching the woven strip on it, pressing and shaping it with his fingers and hand tools so that it adhered smoothly to the core without wrinkles. He followed this with another strip of fabric attaching it to the one before by the rubber cement. This operation he repeated with as many layers as were needed.

The strips of the fabric were cut on the bias, and the warp threads of one strip when set in place were intended

to run from one inner open edge or bead, in a diagonal course, along, across and around the tube to its other open edge or bead. The next strip or layer was reversed so that its warp threads crossed those of the first strip at a selected angle.

There was no difficulty in making the part of the layer on the tread easy and smooth because the curvature there was small, but as the fabric was pressed against the sides and inside of the core, it tended to bagginess and did not lie so smoothly. It would gather and wrinkle. This if carried into the permanent condition of the fabric would greatly weaken the tire. The tendency of woven material, however, is to contract in one direction as it stretches in another. The fabric lengthens circumferentially as it is stretched on the outer periphery. The square meshes thus become diamond shaped along the tread. There is a corresponding longitudinal contraction in the fabric as it is stretched laterally down the sides, so that its shrinking will be greatest as the edges are approached. Thus the wrinkling and bagginess of the fabric may by proper treatment with hand and tool be made to disappear and the strip be shaped smoothly to the sides and beads of the core surface.

At first, the skirts of the fabric were stretched radially along the sides of the core and treated by a saw-tooth tool to avoid wrinkles and then a spinning roll or wheel was spun along the fabric down the core side in a spiral course. There was thus given to the fabric what was called the double stretch and this was supposed to give greater strength and smoothness to the fabric as set upon the core. The workmen, however, found that they could work more rapidly and with less pains if they gave up the saw tooth stretch and depended only on the use of the spinning wheel with which, by increasing the hand speed of the core, they could smooth the fabric against the core without wrinkles. The spinning or stitching of the sides

by the rapid revolution of the core had been previously shown in the kindred art of shaping thin metal sheets over a power driven core. The evidence was that rotation of the core by hand to a speed of fifty or sixty revolutions a minute would give a centrifugal tendency to the skirt of the fabric, keeping it away from the core. By thus doing what the foremen of the shops at first deprecated, the workmen developed a successful improvement in the hand making of tires. The spinning was usually done one side at a time; but powerful workmen were known to work the spinning wheels together on both sides of the core. The spinning of the fabric by rotating the core rapidly was more usual in tires of smaller sizes because the fabric was so stiff that such a method by hand in larger tires was impracticable.

One of the early power machines to make tire casings was patented to Moore in 1894. It disclosed an expansible core upon which an endless rubber fabric was placed and stretched. The core was rotated rapidly by power and the fabric was rolled down by a set of rollers of which one was a spinning roller. This was pivoted to swing radially toward the core but the handle of the spinning wheel was so fixed that it could not travel as far down as the bead.

The Seiberling and Stevens patent of 1904 for making tires sought to do the work of fitting the fabric to the core wholly by machinery, i. e., automatically without the intervention of the hand of the operator. It comprised:

1st. A main power driven shaft to drive the core capable of low or quick revolutions, or entire release,

2nd. A reel carrying the rubber impregnated strip,

3rd. A tension roller retarding the reel and stretching the fabric on the periphery after the free end is attached to the core,

4th. A pressure roller concave in form to match the tread of the strip and press it to the core as it revolves

5th. An arm carrying a laterally spring pressed finger called a jigger finger intended to be reciprocated rapidly, radially of the core, travelling in and out between the tread and in its outer edge, functioning like a human finger in pressing the fabric down against the core and stretching it into shape; and,

6th. A further pressure wheel or spinning roller applied along the edge of the fabric to press it into a crease. The spinning roller was set in a plane at a receding angle to the plane of the core.

The evidence in this record shows that Seiberling and Stevens' device was not successful in its operation and that the automatic operation of the finger was not effective.

The Vincent patent of 1905 had a power driven core, to draw and stretch the fabric with guide rolls through which the fabric was led on its way to the core and which were geared so as to resist the pull of the fabric. As soon as the fabric was spread circumferentially on the core, its skirts or edges were formed down the sides by two sets of spring actuated hammers, arranged progressively in a radial direction so that as the core rotated the fabric was tapped on the sides from their outer portion inwardly toward the bead. This device seems to have had considerable commercial use.

The Mathern Belgian patent of 1906 had a core arranged to be power driven at high and low speeds effected by changing gears, the ratio between the two being 20 to 1. It had a stock roll from which the fabric passed at a tension around guide rolls and between conical gears to secure uniform puckers in the outer edges of the fabric and to hold it out from the core as its middle is delivered circumferentially to become the tread. A screw fed slide was arranged to be moved radially to the core, having suspended on pins a pair of spinning rolls, the handles of which enable the operator to press them laterally against

the skirts of the fabric on the core during their inward radial movement.

The Belgian Mathern patent is attacked as a paper patent because it was allowed to expire through failure to pay the annual Belgian tax. The evidence shows, however, that in 1911 it was offered commercially to the Hood Company which preferred a German patent of the same inventor, and the Belgian machine was actually used for the making of tires which proved to be commercially satisfactory. We do not doubt from the record that it was a practical tire-making machine.

The State patent was applied for March 26, 1909. It was of the same general type as that of Seiberling and Stevens. State's most substantial change was that he discarded the reciprocal, spring-pressed, in and out forming-finger of Seiberling and Stevens and substituted spring-pressed spinning rolls which he supplemented with stitching rolls if needed. He provided, in the same general way as Seiberling and Stevens, a core, a fabric reel, a retarding or tension device, whereby he attached his strip of fabric to the core for the width of the tread portion, leaving the skirts or wings projecting outwardly. Fixed to the base of the frame carrying the core was a standard travelling in a horizontal track with a turret, having four tools mounted at four equidistant points and independent of each other except for their common base. One carried a tread roller, the second the spinning rollers, the third the stitching rolls and the fourth the bead attaching rolls. The operator revolved the turret so as to make the tread roller bear against the tread on the core, then the spinning roll device, then the stitching roll and then the bead forming roll, the latter two of which were not always used. There was no real combination of the operation of the four tools. It was an aggregation not different from a successive use by an operator of hand tools, and so the Circuit Court of Appeals

of the Sixth Circuit held. This was what led to the disclaimer of eight of the claims. It possibly gave the change in the character of the record and proof in this case from that in the Sixth Circuit as remarked upon by the Circuit Court of Appeals of the Third Circuit.

Eleven claims are left. While qualified by disclaimers, consideration of the original claims will serve our purpose. Claims 4, 5, 6 and 7 are for combinations of a sheet fabric supply, a power driven ring core, a radially moving support laterally spring-pressed toward the core, with a spinning roll mounted on the support to shape the sheeted fabric to the core. The variety in the claims is in adding to the spinning roll the element of a receding angle to the plane of the core in the 5th, in giving the spinning roll a round disk shaped edge in the 6th, in giving both the receding angle and the disk shaped edge to the spinning roll in the 7th.

Claims 12 and 13 comprise in their combinations all the above and the slow speed mechanism for actuating the core when the fabric is received from the stock roll, and the high speed mechanism for the spinning rolls to pass over the fabric on the core and shape it.

Claims 22, 23, 24, 25 and 26 cover the same combinations save that they emphasize the feature of the radially moving support of the spinning roll which is power-pressed toward the core.

There was no novelty in the combination of a power-operated core with fabric rolls for delivering the rubber impregnated strips through tension rolls to the core, or in the use of pressure rolls to stretch and press the tread at the slow speed of the core followed by the spinning of the stretching or spinning rolls with high speed down the sides from the outer line of the tread to the bead edge of the fabric, or in the use of the tangential force upon the skirts of the fabric to keep them away from the core. The use of power to revolve the core was seen

in earlier patents in Seiberling and Stevens, in Vincent, and in the Belgian Mathern. The change of speed from slow to rapid revolution by shifting of the gears was shown in the first and third of these. The receding angle of the spinning roller to the plane of the core was not new with State. It was seen in Seiberling and Stevens.

The operation of the spinning wheel in the State patent is said to be automatic. We do not find it to be so. It is partly automatic in that the spinning rolls, when properly placed, are brought closer to the fabric by the springs. The Belgian Mathern device is partly automatic in an analogous way. But when the process of spinning is carried to its completion, the adjustment and pressure of the wheels to the fabric as it approaches the bead edge, need the hand of the operator just as in the hand-making of tires. It is true that the spinning rolls in all these patents are steadied against the fabric in one way or another, as by the power-pressed radially moving support in the State patent; but in the end the hand is needed to complete the spinning process as it nears the bead edge. We do not think that the use of the springs by State in such a combination involves patentable invention when we weigh its inconsiderable importance and note the suggestion of the use of such springs for analogous purposes in Vincent, and in Seiberling and Stevens.

The change from hand to the use of machinery often involves invention. In the making of tires, it has in fact resulted, because of the use of power, in speed of manufacture and possibly in some greater uniformity of the product. But the record does not show that there has been substantial change in the mechanics or method of making. The steps are the same and the succession from one to the other are as in the manual art, and the transfer from hand to power was by the usual appliances and had all been indicated before the State patent.

These conclusions as to the lack of novelty in the elements and combinations of the State patent were reached by the Circuit Court of Appeals for the Sixth Circuit and we agree with them.

The majority opinion of the Third Circuit Court of Appeals in this case attributed much importance and novelty to the effect of the centrifugal force of the revolving core upon the fabric. Its view was that State had discovered that the fabric was thus substantially stretched radially as the spinning wheels hinged against the flowing fabric, and the square meshes on the sides were elongated substantially by the centrifugal force so that at the bead they were lozenge shaped and easily smoothed. We do not find such a new result, or anything different from what was shown in the making of tires by hand. If there were such a newly-developed, substantial addition to the stretching of the material by tangential force, it must have occurred in the Mathern Belgian patent before State. But we find it in neither. The discovery of such a new source of radial stretching power is not testified to by the experts in either hearing.

We are pressed with the argument that many tires, reaching into the millions, have been made under a license granted by Seiberling, and that the success of the device shows the utility and novelty of what he licensed. He gave to his licensees not only the use of the State patent but also that of the Seiberling and Stevens patent. Both patents made large and sweeping claims which were well calculated to induce acquiescence by those without sufficient knowledge of the prior art, or adequate capital to resist. Yet the more comprehensive claims of the State patent have now been disclaimed and the Seiberling and Stevens patent included in his licenses has been abandoned. There has been a complete change about in the Third Circuit law suit. Mr. Seiberling, when these licenses were

granted, was at the head of the great Goodyear Company. He could give great vogue to a device owned and used by him. The license was not a heavy tax, equal to less than one per cent. of the cost of a machine, and purchase of peace was a wise course for the smaller manufacturer. Evidence of this kind is often very persuasive, especially when patentable novelty is in doubt. *Potts* v. *Creager*, 155 U. S. 597, 609; *Magowan* v. *New York Belting Co.*, 141 U. S. 332, 343. But it is by no means conclusive, and must be weighed in the light of all the circumstances, to accord to it its proper significance. *Eibel Process Co.* v. *Minnesota Paper Co.*, 261 U. S. 45, 56; *McClain* v. *Ortmayer*, 141 U. S. 419, 428. In the case before us, we do not think it can overcome the lack of novelty and invention

Seiberling disclaimed combination claims of 4, 5, 6 and 7, except when constructed and coördinated in a certain way. He disclaimed claims 12 and 13 except for the combined operations of a certain kind and unless the recited elements were constructed and coördinated as he described. He disclaimed claims 22, 23, 24, 25 and 26, except when constructed and coördinated for a particular purpose and unless the power drive functioned as he pointed out. As we have found that there is nothing really new in the method or mechanism of State, it will serve no purpose to go through the qualifying disclaimers in detail and consider their effect.

The disclaimers are attacked on the ground that they exceed the legal function of a disclaimer and are an attempt to change a mechanical patent to a process or method patent, something which could only be properly accomplished by a reissue. The Circuit Court of Appeals for the Sixth Circuit examined the possibility of sustaining the alleged invention of State as a process or method patent but concluded that it was fully anticipated by the method of making tires by hand. We do not find it

necessary to pass upon the validity of the method of making disclaimers here pursued, because we agree with the Sixth Circuit Court in failing to find invention in the State device either as a mechanical or as a method patent.

The decree of the Circuit Court of Appeals is reversed and the case is remanded to the District Court with directions to dismiss the bill.

Reversed.